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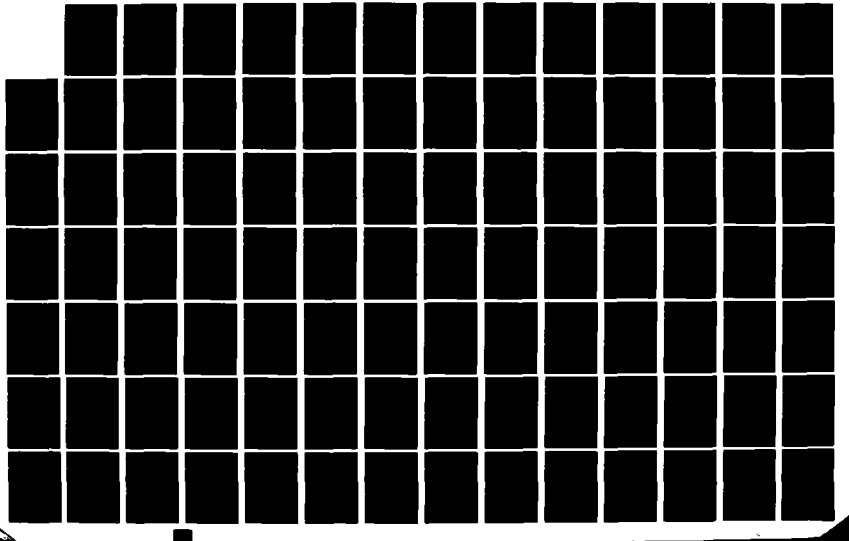

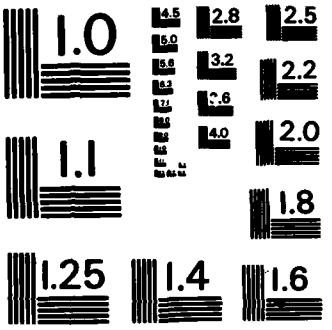

MIL-STD-1553 MULTIPLEX DATA
BUS WORD FORMATS

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Aeronautical Systems Division
Air Force Systems Command
Wright-Patterson Air Force Base, Ohio 45433

Prepared by:

Boeing Military Airplane Company
Seattle, Washington 98124

CHAPTER 11
DATA WORD AND MESSAGE FORMAT GUIDELINES

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11.0 DATA WORD AND MESSAGE FORMAT GUIDELINES

11.1 Introduction

The emphasis in this chapter is the development of data word and message formats for MIL-STD-1553 data bus applications. This chapter is intended as a guide to the designer to identify standard data words and messages that are being used in today's avionic systems and subsystems. These standard words and messages, as well as the documentation format for interface control document (ICD) sheets, provide the basis for defining new 1553 systems. The standards defined in this chapter have met the test of application usage across several 1553 systems and thus provide the acceptable method for transmitting signals of this type in a 1553 system. Also provided in this chapter is the method for developing additional data word formats and messages that may be required by a particular system but are not covered by the standards provided herein. It is essential that any new word formats or message formats that are developed for a 1553 application follow the fundamental guidelines established in this chapter in order to ease future standardization of these words and messages if experience and usage demand it.

The standard word formats presented represent a composite result of studies conducted by the U.S. Air Force, Army, and Navy (see references 1 and 2). Where appropriate, metrification has been considered for future systems and NATO applications. Certain standard words for signals such as distance, velocity, and acceleration are expressed in both English and metric units.

References

1. MIL-STD-1553 Multiplex Data Bus Word Format Study, Boeing Military Airplane Company, October 1981, USAF/ASD Contract No. F33615-80-C-0124.

2. MIL-STD-1553 Data Word Standardization Technical Report, STR-DD-81273-1, SEMCOR, September 1981, U.S. Army Avionics R&D Activity, Contract No. DAAK80-79-C-0258.

The necessity for standardizing data word and message formats became evident as more and more subsystems provided 1553 interfaces as the basic input and output communication interface. Without coordination of these interfaces, outputs from a subsystem were incompatible with the input requirements of the interfacing subsystem. When new 1553 hardware and system design are required, the system designer is responsible for identifying the interface requirements of all devices and establishing compatible words and messages for proper communications. Naturally, this is accomplished during the early system development phases and is then reflected into future procurement specifications for the subsystem elements of the design. This method provides an integrated system that meets all the individual communication requirements. However, as more 1553 systems are developed, this approach may result in subsystems that are incapable of exchanging data because of word and message formatting differences, even though the units meet all the requirements of MIL-STD-1553 and their individual procurement specifications. In this case, the system designer is faced with the choice of using additional processing equipment to translate words and messages from one subsystem to another or

modifying the off-the-shelf hardware to achieve integration. Usually the job of data manipulation falls on the bus controller-processor. Messages from each subsystem must be transmitted to the bus controller (RT to bus controller), which constructs new words with the appropriate engineering units, scaling, encoding, bit positions, etc., before retransmission (bus controller to RT) to the subsystem requiring the data. A similar condition exists for messages when insufficient data in one message require the use of multiple messages. Word order is another message inconsistency that must be solved. The solution to this problem does not lie in bus controller manipulation or in subsystem modifications; it lies in establishing some common usage word formats and some common usage output message formats to provide a subsystem designer the information required to build compatible communication interfaces. This chapter provides the standards and guidelines required to solve this problem.

The following sections are subdivided to allow easy access when selecting the appropriate word or message format from the standards available. For signals that do not fit the standard word formats available, guidelines are provided for establishing the appropriate word format. In addition, recommended standard message formats are identified, and the associated guidelines required for developing other nonstandard message formats are also provided. Standard signal naming practices and an ICD presentation format are provided. Some of the key benefits gained by use of the principles presented in this chapter will be (1) subsystem word format definition, (2) subsystem output message format definition, (3) common signal naming practices, and (4) standardization of interface control document format across programs.

11.2 Data Word Formats

A data word format is the structure, order, and value represented by the bits in a signal data transmission. To properly define a data word format requires knowledge concerning the signal, the 1553 application, and the coding technique used to communicate the information. All of these elements are discussed in the following paragraphs.

The general rules for 1553 word construction (paragraph 11.2.1) apply to all data words whether standard or nonstandard. These rules are to be followed in the development of words that do not fit the formats listed in the standard word tables (paragraph 11.2.5). The procedures on how to construct a data word format described in paragraph 11.2.3 also apply to any data word whether or not it is eventually determined to fit a standard format. Paragraph 11.2.2 describes the standardized ICD presentation format that shall be used for all 1553 data words.

11.2.1 General Rules for Word Construction

The general rules for constructing compatible word formats apply to the standard words listed in paragraph 11.2.5 and to those words that do not meet the requirements for the standardized format. The following paragraphs provide generalized rules for establishing the basic word structure.

11.2.1.1 Data Word/Bit Designation

Figure 11.2-1 shows the horizontal presentation of the 16-bit data field of the data word defined in MIL-STD-1553. The data field bits are numbered 1 through 16, left to right, with bit 1 designated as the most significant bit (MSB) and bit 16 designated as the least significant bit (LSB). In conformance to the requirements of MIL-STD-1553, the most significant bit (bit 1) is transmitted first on the data bus.

The MSB and LSB designations indicated here refer to the relative weighting of the entire 16 bits in a binary-coded numeric representation (BNR) of signal value. The MSB and LSB designations will also be employed to define the most significant and least significant bits of parameters requiring less than or more than 16 bits. There can also be more than one signal value in a data word, thus requiring multiple MSB's and LSB's within the data field. Discrete bits and binary codes are also used to represent characters or modes.

Throughout this document the term "data word" will be used in reference to this 16-bit data field.

11.2.1.2 Signal Coding and Placement

Several coding techniques are provided because of the variety of signal types that must be accommodated in a data word format. The following are the typical coding conventions and the presentation notations:

	Data Type	Presentation Notation
1.	Binary numeric representation (BNR) signed and unsigned	SIGN, MSB, LSB, and * (data bits)
2.	Binary coded decimal (NBCD, 8421)	MSB, LSB, and * (data bits)
3.	Discrete bit	R
4.	Coded bits	R
5.	ASCII alphanumeric codes	MSB, LSB, and * (data bits)
6.	Unused or reserved bits	0
7.	Validity bit	V

Figure 11.2-2 shows some examples of typical word formats employing the above digital representations. The following general rules apply to all word structures:

1. Left justify; the sign, MSB, or first discrete (in that order of precedence) should appear in the left-most (bit 1) position.

2. No unused zero (0) bits should be placed in more significant bit positions than data. Exceptions to this rule are:

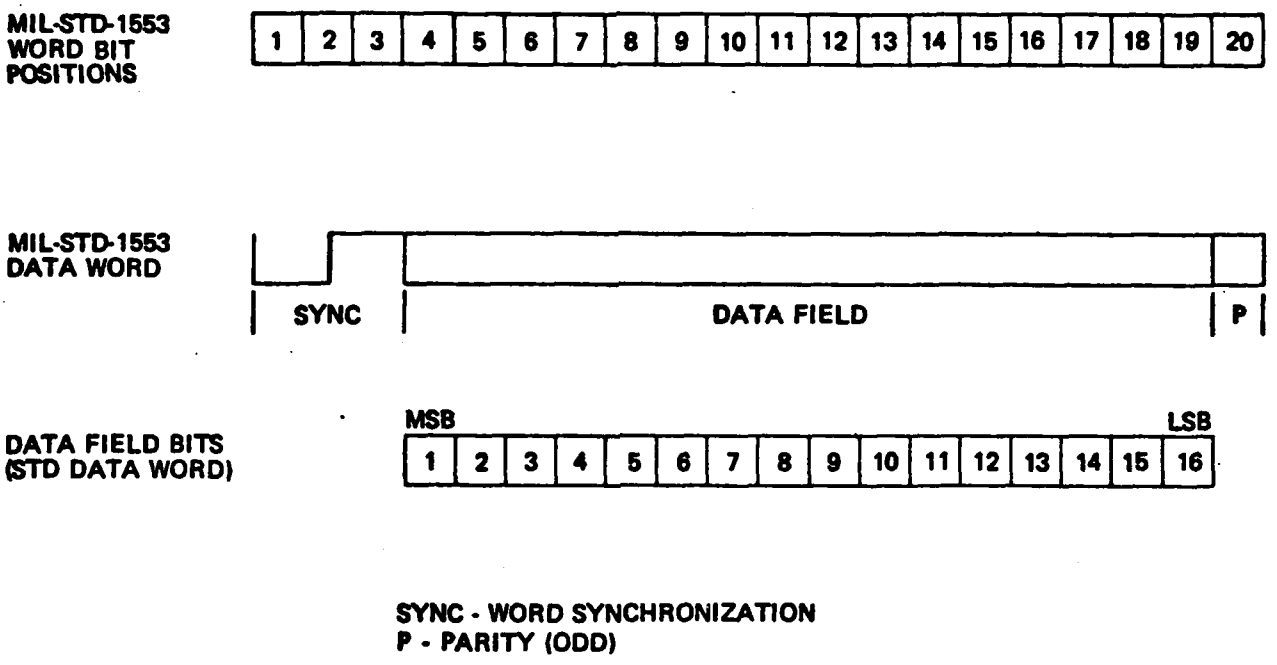
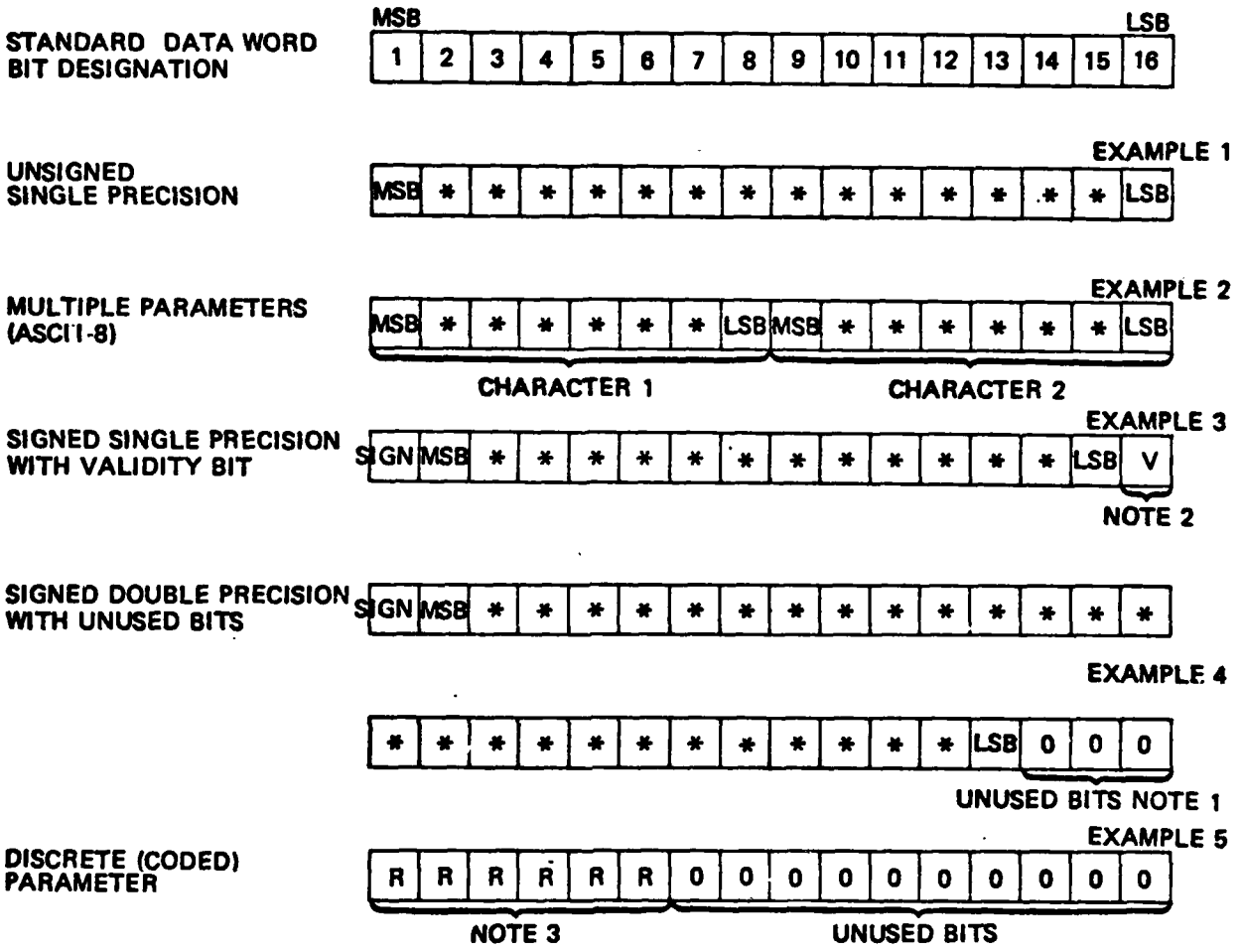


Figure 11.2-1. Standard Data Word Bit Designation Related to MIL-STD-1553 Word Definition



Notes:
1 - Unused or reserved bits are set to zero (0) state
2 - A validity bit (V) may be placed in bit location 16 to specify validity status of transmitted data.
3 - Discrete and coded data are designated by "R" and are defined in the ICD data sheet remarks section

Figure 11.2-2. Examples of Standard Data Words

a. Validity bit always occupies the right-most position (bit 16), if available. (Refer to figure 11.2-2, example 3.)

b. In special cases, unused bits are included for fill. An example is ASCII-7, in eight-bit applications, where the eighth bit is set to zero to format the ASCII-7 code. (Refer to the formats shown in figure 11.2-2, example 2.)

3. Combining BNR, BCD, or other coded data with discrete data in the same word should be avoided.

4. Packing of discretes to data of similar functions within the receiving subsystem should be limited.

Tables 11.2-1 through 11.2-5 show the standardized word presentation format for the examples shown in figure 11.2-2. The presentation format used in the tables is described in detail in paragraph 11.2.2.

11.2.2 Interface Control Document Signal Presentation Format

The ICD format required for the documentation of all data words in a 1553 system is shown in tables 11.2-6 and 11.2-7. Presentation formats are provided for single word or less precision values (table 11.2-6) and double word quantities (table 11.2-7). Signals that require greater than double word precision shall use the single word format with the number of words indicated in the REMARKS section (e.g., 3 word quantity--word 1 of 3) of the word format presentation sheet. The ICD presentation sheet entries are discussed in the following paragraph.

Tables 11.2-6 and 11.2-7 are the skeleton ICD sheets. The definition of each entry is as follows:

DOC. NO.: The interface control document number.

REV.: The revision symbol for this sheet.

DATE: The calendar date of the latest revision to this sheet

PAGE 1 OF: This page count allows multiple pages, for extensive REMARKS or for greater than double word precision data.

SIGNAL NAME: The formal name selected for this signal--A name that is to be used in this and other documents (see Signal Naming, paragraph 11.2.4).

UNITS: The engineering units of the transmitted signal.
Note: Some signals may be unitless.

SOURCE: Name of the subsystem transmitting the signal, usually abbreviated or an acronym.

Table 11.2-1. Example 1, Unsigned Single Precision

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: #

SOURCE:	#	MSB: # NOTE 1		MAX:	#
DESTINATION:	#	LSB: # NOTE 1		MIN:	#
MSG ID:	#	CODING: BNR		SCALE FACTOR:	#
WORD NO.:	#			RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	MSB
BIT-02	*
BIT-03	*
BIT-04	*
BIT-05	*
BIT-06	*
BIT-07	*
BIT-08	*
BIT-09	*
BIT-10	*
BIT-11	*
BIT-12	*
BIT-13	*
BIT-14	*
BIT-15	*
BIT-16	LSB

REMARKS:

NOTE 1 - THE RATIO OF MSB TO LSB IS 32,768 (2E+15)

- APPLICATION DEPENDENT

Table 11.2-2. Example 2, Multiple Parameters, ASCII-8

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: N/A

SOURCE:	#	MSB:	N/A	MAX:	N/A
DESTINATION:	#	LSB:	N/A	MIN:	N/A
MSG ID:	#	CODING:	ASCII-8	SCALE FACTOR:	N/A
WORD NO.:	#			RESOLUTION:	N/A
MSG-LENGTH:	#			ACCURACY:	N/A
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	MSB	
BIT-02	*	
BIT-03	*	
BIT-04	*	
BIT-05	*	ASCII
BIT-06	*	FIRST CHARACTER
BIT-07	*	
BIT-08	LSB	
BIT-09	MSB	NOTE 1
BIT-10	*	
BIT-11	*	
BIT-12	*	ASCII
BIT-13	*	SECOND CHARACTER
BIT-14	*	
BIT-15	*	
BIT-16	LSB	

REMARKS:

NOTE 1 - THE CODING SHOWN ALLOWS FOR ASCII-8. STANDARD ASCII OR USASCII MAY BE EMBEDDED IN THE FIRST SEVEN BITS WITH THE EIGHTH BIT SET TO ZERO.

- APPLICATION DEPENDENT

Table 11.2-3. Examples, Signed Single Precision With Validity Bit

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: #

SOURCE:	#	MSB: #		MAX:	#
DESTINATION:	#	LSB: #		MIN:	#
MSG ID:	#	CODING: 2'S COMPLEMENT/DISCRETE		SCALE FACTOR:	#
WORD NO.:	#			RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	SIGN
BIT-02	MSB
BIT-03	*
BIT-04	*
BIT-05	*
BIT-06	*
BIT-07	*
BIT-08	*
BIT-09	*
BIT-10	*
BIT-11	*
BIT-12	*
BIT-13	*
BIT-14	*
BIT-15	LSB
BIT-16	V - VALIDITY BIT (NOTE 1)

REMARKS:

NOTE 1: V = 0, DATA VALID
V = 1, DATA INVALID

APPLICATION DEPENDENT

Table 11.2-4. Example 4, Signed Double Precision

DOC. NO. #
REV. #
DATE #
Page 1 OF 1

SIGNAL NAME: #

UNITS: #

SOURCE:	#	MSB: #	NOTE 1	MAX:	#
DESTINATION:	#	LSB: #	NOTE 1	MIN:	#
MSG ID:	#	CODING:	2'S COMPLEMENT	SCALE FACTOR:	#
WORD NO.:	#			RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

WORD 1		WORD 2	
BIT-01	SIGN	BIT-01	#
BIT-02	MSB	BIT-02	#
BIT-03	#	BIT-03	#
BIT-04	#	BIT-04	#
BIT-05	#	BIT-05	#
BIT-06	#	BIT-06	#
BIT-07	#	BIT-07	#
BIT-08	#	BIT-08	#
BIT-09	#	BIT-09	#
BIT-10	#	BIT-10	#
BIT-11	#	BIT-11	#
BIT-12	#	BIT-12	#
BIT-13	#	BIT-13	#
BIT-14	#	BIT-14	#
BIT-15	#	BIT-15	#
BIT-16	#	BIT-16	LSB

REMARKS:

NOTE 1 - THE RATIO OF THE MSB TO THE LSB IS 1.0737 X 10^9 (2E+30).

APPLICATION DEPENDENT

Table 11.2-5. Example 5, Discrete (Coded) Parameter

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: # (CDU CONTROL WORD)

UNITS: #

SOURCE:	#	MSB: N/A		MAX:	N/A
DESTINATION:	#	LSB: N/A		MIN:	N/A
MSG ID:	#	CODING: DISCRETE (CODED)		SCALE FACTOR:	N/A
WORD NO.:	#			RESOLUTION:	N/A
MSG-LENGTH:	#			ACCURACY:	N/A
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	R	
BIT-02	R	
BIT-03	R	FUNCTION SELECT CODE
BIT-04	R	NOTE 1
BIT-05	R	
BIT-06	0	
BIT-07	0	
BIT-08	0	
BIT-09	0	
BIT-10	0	
BIT-11	0	
BIT-12	0	
BIT-13	0	
BIT-14	0	
BIT-15	0	
BIT-16	0	

REMARKS: NOTE 1 - FUNCTION SELECT CODES # - APPLICATION DEPENDENT

CODE	FUNCTION
00000	OFF
00001	STORED HEADING ALIGN
00010	G/C ALIGN
00011	AIR ALIGN
00100	NAVIGATE
00101	OVERFLY FIX
00110	AUX. FIX
00111	CALIBRATE
01000	ALTITUDE
01001	TEST
01010 THRU 11111	RESERVED

Table 11.2-6. Presentation Format, Single Precision Quantity

DOC. NO.
REV.
DATE
PAGE 1 OF

SIGNAL NAME:

UNITS:

SOURCE:	MSB:	MAX:
DESTINATION:	LSB:	MIN:
MSG ID:	CODING:	SCALE FACTOR:
WORD NO.:		RESOLUTION:
MSG-LENGTH:		ACCURACY:
TRANSMISSION RATE:		COMPUTATION RATE:

BIT-01
BIT-02
BIT-03
BIT-04
BIT-05
BIT-06
BIT-07
BIT-08
BIT-09
BIT-10
BIT-11
BIT-12
BIT-13
BIT-14
BIT-15
BIT-16

REMARKS:

Table 11.2-7. Presentation Format, Double Precision Quantity

DOC. NO.
REV.
DATE
PAGE 1 OF

SIGNAL NAME:

UNITS:

SOURCE:	MSB:	MAX:
DESTINATION:	LSB:	MIN:
MSG ID:	CODING:	SCALE FACTOR:
WORD NO.:		RESOLUTION:
MSG-LENGTH:		ACCURACY:
TRANSMISSION RATE:		COMPUTATION RATE:

WORD 1	WORD 2
BIT-01	BIT-01
BIT-02	BIT-02
BIT-03	BIT-03
BIT-04	BIT-04
BIT-05	BIT-05
BIT-06	BIT-06
BIT-07	BIT-07
BIT-08	BIT-08
BIT-09	BIT-09
BIT-10	BIT-10
BIT-11	BIT-11
BIT-12	BIT-12
BIT-13	BIT-13
BIT-14	BIT-14
BIT-15	BIT-15
BIT-16	BIT-16

REMARKS:

DESTINATION: Names of the subsystem that will receive the signal, usually abbreviated or an acronym.

MSG ID: Code identifying the message of which this word is part.

WORD NO.: The position of word in the message. If more than one word is required for a signal, the words will be numbered in sequence (e.g., double precision data, words no. 5 and 6). The lowest numbered word will appear on the left in the bit pattern format.

MSG-LENGTH: Length of the message in which this word appears.

TRANSMISSION RATE: The rate in times per second that the message is transmitted.

MSB: The value of the most significant bit of the signal.

LSB: The value of the least significant bit of the signal.

CODING: Binary Numeric Representation (BNR)--A digital (binary) representation in which the decimal value of a bit is related to the adjacent bit by a power of two.

Binary Coded Decimal (BCD)--The natural binary coded decimal (NBCD) or four-bit (8421) code is a special BCD form. The NBCD code allows only 10 (0-9) valid states, with the values 10-15 being invalid.

Two's Complement--A special representation of a signed value BNR where the negative codes are modified to two's complement by adding one to the complement of the number. The use of two's complement in a digital computer facilitates the subtraction process.

Coded--A grouping of bits in which the pattern of ones and zeros has a specified meaning.

Discrete--A single binary bit whose state of one or zero has a specified meaning.

ASCII--A seven-bit binary code representing alpha and numeric characters. An eighth bit is sometimes employed as a parity check bit.

ASCII-8--Extended ASCII using eight bits for additional character representations.

MAX: The maximum value that the signal can attain. On the standard data word format sheets (paragraph 11.2.5), this is the maximum value that can be transmitted using that format.

MIN: The minimum value that the signal can attain. On the standard data word format sheets (paragraph 11.2.5), this is the minimum value that can be transmitted using that format.

SCALE FACTOR: In analog terms, scale factor is a multiplier applied to a parameter value to adjust the signal range to the operating range of the data channel. In digital terms, scale factor is the number of places that the binary point is shifted in converting a binary quantity to its fractional representation (for two's complement fractional encoding) or to its integer representation (for two's complement integer and BNR encoding).

RESOLUTION: Resolution is defined as the minimum detectable change in value. The resolution of a binary number is equal to the LSB value.

ACCURACY: In analog terms, accuracy of a specified parameter is defined as the overall RMS error, expressed in physical units or as a percentage of full range. The RMS error is the difference between the measured value and the actual value of the parameter.

In digital terms, accuracy or precision is related to the number of significant bits and the scaling employed for conversion of the parameter to digital form.

COMPUTATION RATE: The rate in times per second that the data are computed.

11.2.3 How To Construct a Data Word Format

The purpose of this paragraph is to guide the user through the task of establishing the specific data word formats needed for system integration. The information required to start this process is, as a minimum, a signal list. The task will be easier if more information about each signal is known, such as engineering units (if any), maximum and minimum values, resolution, accuracy, and computation rate. This signal information will be required for each signal of the signal list before the word and message format definition can be completed.

The method for establishing a data word format is presented as a flow chart in figure 11.2-3 with an explanation below:

1. Pick a signal from the signal list. Example: present position latitude.

2. Refer to table 11.2-8, Signal Categories, and find the category that applies to the signal. In the example signal, present position latitude, the key word is latitude. Latitude is an angular measurement; therefore, the signal falls in the "angular" category. Note that table 11.2-8 is divided into categories for signals with engineering units and categories of unitless signals. It will be easier to find the appropriate

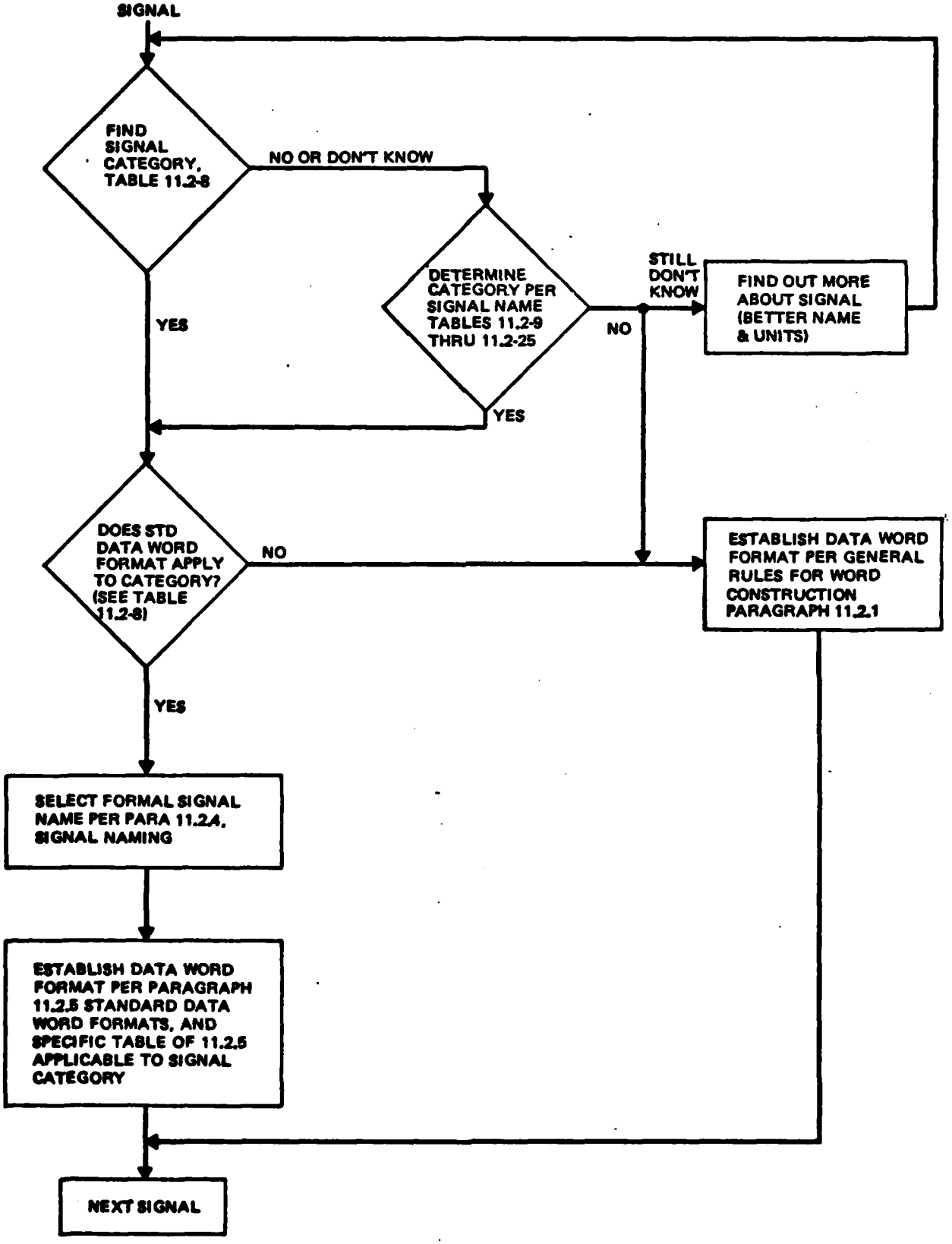


Figure 11.2-3. Method of Establishing a Data Word Format

Table 11.2-8. Signal Categories

Category		Standard Data Word Format
	Categories for Signals with Engineering Units	
1.	Acceleration	Tables 11.2-28 and 11.2-29
2.	Angular	Tables 11.2-30 and 11.2-31
3.	Angular Velocity	Table 11.2-32
4.	Counts	Table 11.2-33
5.	Distance	Tables 11.2-34 through 11.2-40
6.	Frequency	Table 11.2-41
7.	Temperature	Tables 11.2-42 and 11.2-43
8.	Time	Table 11.2-44
9.	Velocity	Tables 11.2-45 through 11.2-49
10.	Voltage	Tables 11.2-50 through 11.2-52
	Categories of Unitless Signals	
1.	Communications	Tables 11.2-53 and 11.2-54
2.	Data Validity	Tables 11.2-55 through 11.2-57
3.	Display Data	Table 11.2-58
4.	Header Word	Table 11.2-59
5.	Navigation	Tables 11.2-60 through 11.2-64
6.	Stores Management/ Weapons Delivery	Tables 11.2-65 through 11.2-69

category if it is known whether the signal is unitless or which units apply.

After the signal category is determined, go to step 4. If the category cannot be determined or there is uncertainty whether the signal really fits in a given category, go to step 3.

3. Refer to tables 11.2-10 through 11.2-25. These tables contain common signal names in alphabetical order. These signals are listed with the keyword first and then typical modifiers. The category to which each signal belongs can be used to provide the data needed for step 2. The method is to find a match or close match to the signal name and note the associated category. The example signal, present position latitude, would match the table entry keyword "latitude," typical modifiers "present position," in table 11.2-11, Signal Names, Angular Category.

   If the signal category has been determined, go to step 4. If there is still uncertainty about the signal category, get a better definition of the signal. Determine more descriptive or functional details about the signal, including the source, destination, name, and engineering units (if any). Then go back to step 2. If the signal definitely does not fall into any of the listed categories, refer to paragraph 11.2.1, General Rules for Word Construction, for general guidance in establishing the data word format for this signal.

4. Refer to table 11.2-8 again. For the example signal, present position latitude, the correct category is "angular" and in the standard data word format column of the table we find and note for later use the reference to tables 11.2-30 and 11.2-31. Find the category of your signal in table 11.2-8 and note the tables referenced in the standard data word format column.

5. A necessary part of data word format development is the selection of a formal signal name for each signal. Refer to paragraph 11.2.4, Signal Naming, to select the formal signal name. Return and proceed to step 6.

6. Refer to paragraph 11.2.5, Standard Data Word Formats and the applicable tables (noted in step 4). Construct the data word format and complete the ICD data sheet(s) for this signal.

7. Select next signal from signal list and start the process at step 2.

11.2.4 Signal Naming

A necessary part of data word format development is the selection of a formal signal name for each signal. A naming convention will make signals more easily traceable within an integrated system as well as across various systems.

The basic principle for naming signals consistently is placing the most important word (keyword) first, followed by modifiers. The keyword is the word most related to the category or engineering units (if any) of the signal. The keyword may be the same as the signal category.

Table 11.2-9. Index of Signal Name Tables

Category	Signal Name Table
Acceleration	Table 11.2-10
Angular	Table 11.2-11
Angular Velocity	Table 11.2-12
Counts	Table 11.2-13
Distance	Table 11.2-14
Frequency	Table 11.2-15
Temperature	Table 11.2-16
Time	Table 11.2-17
Velocity	Table 11.2-18
Voltage	Table 11.2-19
Communications	Table 11.2-20
Data Validity	Table 11.2-21
Display Data	Table 11.2-22
Header Word	Table 11.2-23
Navigation	Table 11.2-24
Stores Management	Table 11.2-25

Table 11.2-10. Signal Names, Acceleration Category

Keyword	Typical Modifiers
Acceleration	Normal Target, X Target, Y Target, Z X Y Z

Table 11.2-11. Signal Names, Angular Category

Keyword	Typical Modifiers
Angle	AOA (Angle-of-Attack) AOA, Error AOA, True Drift Ground Track Ground Track, Present Pitch Roll Sideslip Tilt
Azimuth	Platform Relative Relative to Steerpoint Relative to Nth Waypoint Relative to Nth Markpoint Symbol
Bearing	Same as Azimuth
Course	Magnetic, Computed Magnetic, Inserted
Elevation	Bullet Circle Command Angle LOS (Loss-of-Signal) Position Reference, Aircraft Scale
Heading	Error Magnetic Magnetic, Inserted Magnetic, Present True True, Inserted True, Present
Latitude	Markpoint Nth Markpoint Nth Waypoint Present Position, Inserted Waypoint Position, Inserted
Longitude	Same as Latitude
Variation	Magnetic, Computed Magnetic, Inserted

Table 11.2-12. Signal Names, Angular Velocity Category

Keyword	Typical Modifiers
Gyro Bias	Correction X Correction Y Correction Z
Pitch Rate	None
Roll Rate	None
Yaw Rate	None

Table 11.2-13. Signal Names, Counts Category

Keyword	Typical Modifiers
Counts	Track Control, RN Track Control, N
Frames	Film Recording Data
Pulses	Ripple
Revolutions	Rotor Speed No. n
Rounds	Remaining
Words	Instrumentation Port Data

Table 11.2-14. Signal Names, Distance Category (Sheet 1 of 2)

Keyword	Typical Modifiers
Altitude	Above Fixpoint Barometric Barometric Reference Desired Electronic Altimeter Helo (Helicopter) Inertial Pressure Radar Sonobuoy Launch System
Azimuth	Cursor Deviation Steering Steering Dot
Circle	Display
Distance	To Nth Waypoint/Markpoint To Steerpoint
Easting	Inserted Position Inserted Waypoint Nth Waypoint/Markpoint UTM Present Position UTM
Elevation	Same as Azimuth
Error	Allowable Steering Position East Position North
Height	Above Target (HAT)
Northing	Same as Easting
Range	Aircraft Symbol Contact Ground Track, Incremental Manual Maximum Minimum Pull Up Radar Slant TACAN Tactical

Table 11.2-14. Signal Names, Distance Category (Sheet 2 of 2)

Keyword	Typical Modifiers
Range (Cont'd)	X, Relative Target Y, Relative Target Z, Relative Target
Rate Position	Acquisition Cursor
Separation	Impact
Wingspan	None
X	Cursor Correction Cursor Total Delta Display Delta Display Position Display - Translate Helo Position Helo Position at Initialization Ownship Position Pointer Position Position Position, Fly to Point Sonobuoy, Position Symbol Position
Y	Same as X
Z	Cursor Total Position

Table 11.2-15. Signal Names, Frequency Category

Keyword	Typical Modifiers
Frequency	HF-n UHF-n VHF-n

Table 11.2-16. Signal Names, Temperature Category

Keyword	Typical Modifiers
Temperature	Degrees C Degrees Celsius Outside Air True Freestream Air

Table 11.2-17. Signal Names, Time Category

Keyword	Typical Modifiers
Calendar	None
Clock	Kalman
Time	Align Coordinated Universal Greenwich Mean Of Day Sonobuoy, Last Correct Sonobuoy Launch Symbol Tag To Nth Waypoint/Markpoint To Steerpoint

Table 11.2-18. Signal Names, Velocity Category

Keyword	Typical Modifiers
Airspeed	Calibrated Indicated True
Groundspeed	Predicted Present Tail Warning System
MACH	Number
Range Rate	None
Speed	Bias Desired Helo Helo Wind Ownship Symbol
Velocity	Correction X Correction Y Doppler Drift Doppler Heading Doppler Vertical Drift Heading Vertical Wind X X, Relative Target Y Y, Relative Target Z Z, Relative Target

Table 11.2-19. Signal Names, Voltage Category

Keyword	Typical Modifiers
Voltage	Display Intensity Fore/Aft Cursor Deflection Left/Right Cursor Deflection Stick X Deflection Stick Y Deflection

Table 11.2-20. Signal Names, Communications Category

Keyword	Typical Modifiers
Channel	Select
IFF	Code Control Interrogator
Radio	Select Status Test
Receiver	Channel Command Frequency Tune
RF	Channel Disposition Level Transmit
UHF	Channel Mode

Table 11.2-21. Signal Names, Data Validity Category

Keyword	Typical Modifiers
Check (CRC)	Cyclic Redundancy
Checksum	Bits Word
Validity	Bit Data Discretes

Table 11.2-22. Signal Names, Display Data Category

Keyword	Typical Modifiers
Bar	Horizontal Vertical
Character	Left Middle Right
Display	Alpha Border Branch Character Control Data Intensity Miscellaneous Numeric Position Radar Symbol Window
Symbol	Control Identification Internal Reference

Table 11.2-23. Signal Names, Header Word Category

Keyword	Typical Modifiers
Header	BIT Display/Control Interrogator Control Message ID Position Tune Receiver Weapon Inventory Weapon Release Word Count

Table 11.2-24. Signal Names, Navigation Category

Keyword	Typical Modifiers
Convergence Factor	Inserted Present, In Use
Direction Cosines	a. CXX, CXY, CXZ — Reference platform to Earth coordinate system b. DIRXL, DIRYL, DIRZL — Reference A/C body coordinate system c. DIRCOSX, DIRCOSY, DIRCOSZ (Same as b.)
Position	Grid Zone Inserted Present Spheroid UTM Grid Zone UTM 100,000 Meter Grid Zone
Waypoint/Markpoint	Inserted Nth UTM Grid Zone UTM 100,000 Meter Grid Zone

Table 11.2-25. Signal Names, Stores Management Category

Keyword	Typical Modifiers
Station	Store Weapon
Store	Bomb Ejector Missile Rack Sonobouy Weapon
(Store Type) Control	Arm Jettison Launch Release Safe Select
(Store Type) Monitor	ID Inventory Position Status Test

Table 11.2-9 is an index of the signal name tables (tables 11.2-10 through 11.2-25), which present typical signal names by category. Within each table is a list of keywords associated with that category and some typical modifiers associated with those keywords. These tables should be helpful in selecting a formal signal name by using the following procedure:

1. Find the appropriate table for your signal category. For our example signal, present position latitude, the category is "angular"; therefore, we find that the appropriate table is 11.2-11.

2. Determine if your signal's keyword is listed. For the example signal, present position latitude, the keyword is "latitude" and is listed in table 11.2-11.

3. If your signal's keyword is not listed in the appropriate category table, consider using the category name as your signal's keyword. If the category name is an inappropriate keyword for your signal, choose the most meaningful word in the name as the keyword.

4. Define your signal's formal name by placing the keyword first, followed by the remaining words (modifiers). The table for your signal's category lists some typical modifiers for common keywords. The formal name for our example signal would therefore be "latitude, present position."

5. Return to paragraph 11.2.3 to complete data word format definition.

11.2.5 Standard Data Word Formats

This paragraph presents the standard data word formats, and provides the user guidance necessary to fit real-life signals into the standard data word formats. An example signal is used to illustrate the application of the standard data word formats to real-life signals. The derivation of the example data word is presented below, and the completed data word format is presented in table 11.2-26.

Table 11.2-27 is an index that keys the user into the various standard data word formats. The standard data word formats are presented in tables 11.2-28 through 11.2-69. Having established the category of your signal (by following the method of paragraph 11.2.3), refer to the appropriate standard data word format(s), as indexed in table 11.2-27, and to the following example for guidance.

An effective means of guiding the user in establishing data word formats for his signals is by example. We have been using a typical signal, "latitude, present position," as our example. The data word format for this signal is derived as follows. It is necessary to have certain information about the signal before the data word format can be defined. For signals that have engineering units, the minimum necessary information is (1) the formal signal name (established in paragraph 11.2.4), (2) the engineering units, (3) the range (maximum and minimum) of signal value, and (4) the resolution required.

Table 11.2-26. Data Word Format for Example Signal

DOC. NO. #
REV. #
DATE #
Page 1 OF 1

SIGNAL NAME: LATITUDE, PRESENT POSITION

UNITS: SEMICIRCLES

SOURCE:	GPS	MSB: 1/2	MAX: +1/2
DESTINATION:	INS	LSB: 2E-26 (1.49×10^{-8})	MIN: -1/2
MSG ID:	#	CODING: 2'S COMPLEMENT	SCALE FACTOR: 1
WORD NO.:	#	FRACTIONAL	RESOLUTION: 1.52×10^{-8}
MSG-LENGTH:	#		ACCURACY: #
TRANSMISSION RATE:	#		COMPUTATION RATE: #

WORD 1		WORD 2	
BIT-01	SIGN	BIT-01	#
BIT-02	MSB	BIT-02	#
BIT-03	#	BIT-03	#
BIT-04	#	BIT-04	#
BIT-05	#	BIT-05	#
BIT-06	#	BIT-06	#
BIT-07	#	BIT-07	#
BIT-08	#	BIT-08	#
BIT-09	#	BIT-09	#
BIT-10	#	BIT-10	#
BIT-11	#	BIT-11	LSB
BIT-12	#	BIT-12	0
BIT-13	#	BIT-13	0
BIT-14	#	BIT-14	0
BIT-15	#	BIT-15	0
BIT-16	#	BIT-16	0

REMARKS:

APPLICATION DEPENDENT

POSITIVE SENSE: PLUS IS NORTH

The following information is used in our example:

SIGNAL NAME: LATITUDE, PRESENT POSITION
UNITS: DEGREES
RANGE: ±90 DEGREES (POSITIVE IS NORTH)
RESOLUTION: 2.73×10^{-6} DEGREES

Refer to the index in table 11.2-27. We established that the category of our example signal is "angular." The index refers us to table 11.2-30 for angular category, single precision, and to table 11.2-31 for angular category, double precision. Proceed as follows to decide whether data word will be single or double precision:

1. Is RANGE of signal covered by MAX and MIN of standard data word format? If not, define data word format for the signal by using the General Rules for Word Construction, paragraph 11.2.1, and the standard data word formats as examples.

   The RANGE of our signal is ±90 DEGREES. We see that the UNITS of the standard data word format are SEMICIRCLES so we must convert all signal parameters from DEGREES to SEMICIRCLES. To convert, divide DEGREES by 180. The signal RANGE (±90 DEGREES) becomes ±0.5 SEMICIRCLES, and is within the MAX (+1) and MIN (-1) of the standard format for both single and double precision.

2. Can the required signal RESOLUTION be transmitted using the single precision standard format? If yes, proceed; if no, can double precision standard format accommodate RESOLUTION? If yes, proceed; if no, refer to paragraph 11.2.1, General Rules for Word Construction, and define data word format for the signal using the standard data word formats as examples.

   The example signal's required RESOLUTION is 2.73×10^{-6} DEGREES or after conversion 1.52×10^{-8} SEMICIRCLES. The LSB value of the single precision standard format (which is the standard format's best resolution) is 2E-15 (i.e., 3.05×10^{-5}) SEMICIRCLES. The single precision standard format with resolution of 3.05×10^{-5} cannot accommodate the 1.52×10^{-8} resolution required. The LSB value of the double precision standard format is 2E-31 (i.e., 4.66×10^{-10}) SEMICIRCLES, which is sufficient to accommodate the 1.52×10^{-8} signal resolution.

By the above steps it was determined that the appropriate standard data word format for the example signal is table 11.2-31, for angular category, double precision. Now use a blank ICD presentation format sheet (see tables 11.2-6 and 11.2-7 for single and double precision formats, respectively) as a worksheet and to document the data word format that will be derived. We need to use the ICD format of table 11.2-7 because our example data word will be double precision. The completed ICD presentation for our example signal's data word format is shown in table 11.2-26. The derivation of each entry, which is not application dependent, is as follows:

1. SIGNAL NAME: LATITUDE, PRESENT POSITION (formal signal name, selected in paragraph 11.2.4).

2. UNITS: SEMICIRCLES (as specified in standard data word format).

3. SOURCE: GPS (source of example signal).

4. DESTINATION: INS (destination of example signal).

5. MSB: 0.5 (MSB value as specified in standard data word format).
   Note: The MSB value is fixed for each standard data word format; therefore, the maximum range transmittable (MAX and MIN) of each data word format is fixed.

6. LSB: 1.49×10^{-8} (2E-26). Notice note 1 of standard format, table 11.2-3C, which states: "the LSB value and location may be changed, as required, to adjust resolution of data word format. Any bits after LSB must be set to zero." The full resolution of the double precision standard angular format (4.66×10^{-8}) is not required; therefore, the LSB location was adjusted to BIT-11 of word 2 to provide an LSB value (1.49×10^{-8}) just under the signal resolution (1.52×10^{-8}). The five bits after the LSB are set to zero.

7. CODING: The encoding format of the digital data is 2's COMPLEMENT FRACTIONAL notation, as specified in the standard format.

8. MAX: The maximum value of our signal is +0.5 SEMICIRCLES (converted from +90 DEGREES).

9. MIN: The minimum value of our signal is -0.5 SEMICIRCLES (converted from -90 DEGREES).

10. SCALE FACTOR: 1 (as specified in standard data word format).

11. RESOLUTION: 1.52×10^{-8} (the signal resolution).

12. WORD 1: This defines the bit assignments for the first data word. This is a signed quantity; therefore, BIT-01 is the SIGN. BIT-02 is the MSB (MSB of data is transmitted first per MIL-STD-1553B). BIT-03 through BIT-16 are data bits (#=Data Bit).

13. WORD 2: This defines the bit assignments for the second data word. BIT-01 through BIT-10 are data bits. BIT-11 is the LSB, whose location was selected to match the signal resolution. BIT-12 through BIT-16 are set to 0, as specified in note 1 of the standard format.

14. REMARKS: POSITIVE SENSE: PLUS IS NORTH (statement that data is transmitted as plus equals north latitude).

Table 11.2-27. Standard Data Word Format Index (Sheet 1 of 2)

Category	Subcategory	Table No.
Acceleration	Feet/Second^2 Single Precision	11.2-28
	Meters/Second^2, Double Precision	11.2-29
Angular	Single Precision	11.2-30
	Double Precision	11.2-31
Angular Velocity	Single Precision	11.2.32
Counts	Single Precision	11.2-33
Distance	Feet, Single Precision	11.2-34
	Feet, Double Precision	11.2-35
	Meters, Double Precision	11.2-36
	Kilometers, Double Precision	11.2-37
	UTM Grid Zone, Northing/Easting; Single Precision	11.2-38
	Nautical Miles, Low Range, Single Precision	11.2-39
	Nautical Miles, High Range, Single Precision	11.2-40
Frequency	Four Words	11.2-41
Temperature	Low Range, Single Precision	11.2-42
	High Range, Single Precision	11.2-43
Time	Time of Day, Six Words	11.2-44
Velocity	Feet/Second, Single Precision	11.2-45
	Feet/Second, Double Precision	11.2-46
	Meters/Second, Double Precision	11.2-47
	Knots, Single Precision	11.2-48
	Mach, Single Precision	11.2-49
Voltage	High Range, Single Precision	11.2-50
	Mid Range, Single Precision	11.2-51
	Low (Millivolt) Range, Single Precision	11.2-52
Communications	Channel Select	11.2-53
	Radio Selection	11.2-54
Data Validity	Checksum	11.2-55
	Cyclic Redundancy Check	11.2-56
	Validity Bit	11.2-57
Display Data	Character Display	11.2-58
Header Word	Message Header	11.2-59

Table 11.2-27. Standard Data Word Format Index (Sheet 2 of 2)

Category	Subcategory	Table No.
Navigation	Convergence Factor	11.2-60
	Direction Cosine, Platform To Earth Coordinates	11.2-61
	Direction Cosine, Aircraft Body Coordinates	11.2-62
	100,000 Meter Grid Zone	11.2-63
	Spheroid/UTM Grid Zone	11.2-64
Stores Management	Laser Code	11.2-65
	Release Command Code	11.2-66
	Store Inventory	11.2-67
	Station/Store Status	11.2-68
	Weapon Selection (ID/QTY)	11.2-69

Table 11.2-28. Standard Data Word Format, Acceleration Category, Subcategory Feet/Second^2, Single Precision

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: FT/SEC^2

SOURCE:	#	MSB:	512	MAX:	+1024
DESTINATION:	#	LSB:	2E-5 (NOTE 1)	MIN:	-1024
MSG ID:	#	CODING:	2's COMPLEMENT	SCALE FACTOR:	32
WORD NO.:	#		INTEGER	RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	SIGN
BIT-02	MSB
BIT-03	#
BIT-04	#
BIT-05	#
BIT-06	#
BIT-07	#
BIT-08	#
BIT-09	#
BIT-10	#
BIT-11	#
BIT-12	#
BIT-13	#
BIT-14	#
BIT-15	#
BIT-16	LSB (NOTE 1)

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

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Table 11.2-29. Standard Data Word Format, Acceleration Category, Subcategory Meters/Second^2, Double Precision

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: METERS/SECOND^2

SOURCE:	#	MSB:	512	MAX:	+1024
DESTINATION:	#	LSB:	0.000976	MIN:	-1024
MSG ID:	#	CODING:	2's COMPLEMENT	SCALE FACTOR:	2E21
WORD NO.:	#		INTEGER	RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	SIGN	BIT-01	#
BIT-02	MSB	BIT-02	#
BIT-03	#	BIT-03	#
BIT-04	#	BIT-04	#
BIT-05	#	BIT-05	LSB
BIT-06	#	BIT-06	0
BIT-07	#	BIT-07	0
BIT-08	#	BIT-08	0
BIT-09	#	BIT-09	0
BIT-10	#	BIT-10	0
BIT-11	#	BIT-11	0
BIT-12	#	BIT-12	0
BIT-13	#	BIT-13	0
BIT-14	#	BIT-14	0
BIT-15	#	BIT-15	0
BIT-16	# (NOTE 1)	BIT-16	0

REMARKS:

NOTE 1: IF A RESOLUTION FINER THAN 0.03125 M/SEC^2 IS REQUIRED, USE WORDS 1 AND 2. IF A RESOLUTION 0.03125 M/SEC^2 OR COARSER IS REQUIRED, USE ONLY WORD 1. THE LSB (BIT 16) OF WORD 1 IS EQUAL TO 0.03125 M/SEC^2.

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Table 11.2-30. Standard Data Word Format, Angular Category, Single Precision

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: SEMICIRCLES

SOURCE:	#	MSB: 1/2		MAX:	+1
DESTINATION:	#	LSB: 2E-15 (NOTE 1)		MIN:	-1
MSG ID:	#	CODING:	2's COMPLEMENT	SCALE FACTOR:	1
WORD NO.:	#		FRACTIONAL	RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	SIGN
BIT-02	MSB
BIT-03	#
BIT-04	#
BIT-05	#
BIT-06	#
BIT-07	#
BIT-08	#
BIT-09	#
BIT-10	#
BIT-11	#
BIT-12	#
BIT-13	#
BIT-14	#
BIT-15	#
BIT-16	LSB (NOTE 1)

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

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Table 11.2-31. Standard Data Word Format, Angular Category, Double Precision

DOC. NO. #
REV. #
DATE #
Page 1 OF 1

SIGNAL NAME: #

UNITS: SEMICIRCLES

SOURCE:	#	MSB:	1/2	MAX:	+1
DESTINATION:	#	LSB:	2E-31 (NOTE 1)	MIN:	-1
MSG ID:	#	CODING:	2's COMPLEMENT	SCALE FACTOR:	1
WORD NO.:	#		FRACTIONAL	RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

WORD 1		WORD 2	
BIT-01	SIGN	BIT-01	*
BIT-02	MSB	BIT-02	*
BIT-03	*	BIT-03	*
BIT-04	*	BIT-04	*
BIT-05	*	BIT-05	*
BIT-06	*	BIT-06	*
BIT-07	*	BIT-07	*
BIT-08	*	BIT-08	*
BIT-09	*	BIT-09	*
BIT-10	*	BIT-10	*
BIT-11	*	BIT-11	*
BIT-12	*	BIT-12	*
BIT-13	*	BIT-13	*
BIT-14	*	BIT-14	*
BIT-15	*	BIT-15	*
BIT-16	*	BIT-16	LSB (NOTE 1)

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

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Table 11.2-32. Standard Data Word Format, Angular Velocity Category, Single Precision

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: SEMICIRCLES/SECOND

SOURCE:	#	MSB:	2	MAX:	+4
DESTINATION:	#	LSB:	2E-13 (NOTE 1)	MIN:	-4
MSG ID:	#	CODING:	2's COMPLEMENT	SCALE FACTOR:	2E-2
WORD NO.:	#		FRACTIONAL	RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	SIGN
BIT-02	MSB
BIT-03	*
BIT-04	*
BIT-05	*
BIT-06	*
BIT-07	*
BIT-08	*
BIT-09	*
BIT-10	*
BIT-11	*
BIT-12	*
BIT-13	*
BIT-14	*
BIT-15	*
BIT-16	LSB (NOTE 1)

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

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Table 11.2-33. Standard Data Word Format, Counts Category, Single Precision

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: (NOTE 1)

SOURCE:	#	MSB:	32,768	MAX:	65,536
DESTINATION:	#	LSB:	1	MIN:	0
MSG ID:	#	CODING:	BNR	SCALE FACTOR:	1
WORD NO.:	#			RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	MSB
BIT-02	*
BIT-03	*
BIT-04	*
BIT-05	*
BIT-06	*
BIT-07	*
BIT-08	*
BIT-09	*
BIT-10	*
BIT-11	*
BIT-12	*
BIT-13	*
BIT-14	*
BIT-15	*
BIT-16	LSB

REMARKS:

NOTE 1: UNITS MAY BE ANY WITH INTEGER VALUES; SUCH AS, COUNTS, FRAMES, PULSES, REVOLUTIONS, ROUNDS AND WORDS.

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Table 11.2-34. Standard Data Word Format, Distance Category, Subcategory Feet, Single Precision

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: FEET

SOURCE:	#	MSB:	16,384	MAX:	+32,768
DESTINATION:	#	LSB:	1 (NOTE 1)	MIN:	-32,768
MSG ID:	#	CODING:	2's COMPLEMENT	SCALE FACTOR:	1
WORD NO.:	#		INTEGER	RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	SIGN
BIT-02	MSB
BIT-03	*
BIT-04	*
BIT-05	*
BIT-06	*
BIT-07	*
BIT-08	*
BIT-09	*
BIT-10	*
BIT-11	*
BIT-12	*
BIT-13	*
BIT-14	*
BIT-15	*
BIT-16	LSB (NOTE 1)

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

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Table 11.2-35. Standard Data Word Format, Distance Category, Subcategory Feet, Double Precision

DOC. NO. #
REV. #
DATE #
Page 1 OF 1

SIGNAL NAME: #

UNITS: FEET

SOURCE: #	MSB: 16,777,216	MAX: +33,554,432	
DESTINATION: #	LSB: 2E-6 (NOTE 1)	MIN: -33,554,432	
MSG ID: #	CODING: 2's COMPLEMENT	SCALE FACTOR: 64	
WORD NO.: #	INTEGER	RESOLUTION:	#
MSG-LENGTH: #		ACCURACY:	#
TRANSMISSION RATE: #		COMPUTATION RATE:	#

WORD 1		WORD 2	
BIT-01	SIGN	BIT-01	#
BIT-02	MSB	BIT-02	#
BIT-03	#	BIT-03	#
BIT-04	#	BIT-04	#
BIT-05	#	BIT-05	#
BIT-06	#	BIT-06	#
BIT-07	#	BIT-07	#
BIT-08	#	BIT-08	#
BIT-09	#	BIT-09	#
BIT-10	#	BIT-10	#
BIT-11	#	BIT-11	#
BIT-12	#	BIT-12	#
BIT-13	#	BIT-13	#
BIT-14	#	BIT-14	#
BIT-15	#	BIT-15	#
BIT-16	#	BIT-16	LSB (NOTE 1)

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

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Table 11.2-36. Standard Data Word Format, Distance Category, Subcategory Meters, Double Precision

DOC. NO. #
REV. #
DATE #
Page 1 OF 1

SIGNAL NAME: # (ALTITUDE)

UNITS: METERS

SOURCE:	#	MSB: 8,388,608	MAX: +16,777,216
DESTINATION:	#	LSB: 0.0078	MIN: -16,777,216
MSG ID:	#	CODING: 2's COMPLEMENT	SCALE FACTOR: 128
WORD NO.:	#	INTEGER	RESOLUTION: #
MSG-LENGTH:	#		ACCURACY: #
TRANSMISSION RATE:	#		COMPUTATION RATE: #

WORD 1		WORD 2	
BIT-01	SIGN	BIT-01	*
BIT-02	MSB	BIT-02	*
BIT-03	*	BIT-03	*
BIT-04	*	BIT-04	*
BIT-05	*	BIT-05	*
BIT-06	*	BIT-06	*
BIT-07	*	BIT-07	*
BIT-08	*	BIT-08	*
BIT-09	*	BIT-09	*
BIT-10	*	BIT-10	*
BIT-11	*	BIT-11	*
BIT-12	*	BIT-12	*
BIT-13	*	BIT-13	*
BIT-14	*	BIT-14	*
BIT-15	*	BIT-15	*
BIT-16	*	BIT-16	LSB

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

APPLICATION DEPENDENT

Table 11.2-37. Standard Data Word Format, Distance Category, Subcategory Kilometers, Double Precision

DOC. NO. #
REV. #
DATE #
Page 1 OF 1

SIGNAL NAME: # (RANGE)

UNITS: KILOMETERS

SOURCE:	#	MSB:	32,768	MAX:	65,536
DESTINATION:	#	LSB:	0.0000153	MIN:	0
MSG ID:	#	CODING:	BNR	SCALE FACTOR:	2E16
WORD NO.:	#			RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

WORD 1		WORD 2	
BIT-01	MSB	BIT-01	*
BIT-02	*	BIT-02	*
BIT-03	*	BIT-03	*
BIT-04	*	BIT-04	*
BIT-05	*	BIT-05	*
BIT-06	*	BIT-06	*
BIT-07	*	BIT-07	*
BIT-08	*	BIT-08	*
BIT-09	*	BIT-09	*
BIT-10	*	BIT-10	*
BIT-11	*	BIT-11	*
BIT-12	*	BIT-12	*
BIT-13	*	BIT-13	*
BIT-14	*	BIT-14	*
BIT-15	*	BIT-15	*
BIT-16	* (NOTE 1)	BIT-16	LSB

REMARKS:

NOTE 1: IF A RESOLUTION FINER THAN 1 KILOMETER IS REQUIRED, USE WORDS 1 AND 2. IF A RESOLUTION OF 1 KILOMETER OR COARSER IS REQUIRED, USE ONLY WORD 1. THE LSB (BIT 16) OF WORD 1 IS EQUAL TO 1 KILOMETER

APPLICATION DEPENDENT

Table 11.2-38. Standard Data Word Format, Distance Category, Subcategory UTM Grid Zone, Northing/Easting, Single Precision

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: METERS

SOURCE:	#	MSB:	65,536	MAX:	99,998
DESTINATION:	#	LSB:	2	MIN:	0
MSG ID:	#	CODING:	BNR	SCALE FACTOR:	1/2
WORD NO.:	#			RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	MSB
BIT-02	#
BIT-03	#
BIT-04	#
BIT-05	#
BIT-06	#
BIT-07	#
BIT-08	#
BIT-09	#
BIT-10	#
BIT-11	#
BIT-12	#
BIT-13	#
BIT-14	#
BIT-15	#
BIT-16	LSB

REMARKS:

APPLICATION DEPENDENT

Table 11.2-39. Standard Data Word Format, Distance Category, Subcategory Nautical Miles (Low Range), Single Precision

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: NAUTICAL MILES

SOURCE:	#	MSB: 327.68	MAX: 655.36
DESTINATION:	#	LSB: 0.01 (NOTE 1)	MIN: 0
MSG ID:	#	CODING: BNR	SCALE FACTOR: 100
WORD NO.:	#		RESOLUTION: #
MSG-LENGTH:	#		ACCURACY: #
TRANSMISSION RATE:	#		COMPUTATION RATE: #

BIT-01	MSB
BIT-02	*
BIT-03	*
BIT-04	*
BIT-05	*
BIT-06	*
BIT-07	*
BIT-08	*
BIT-09	*
BIT-10	*
BIT-11	*
BIT-12	*
BIT-13	*
BIT-14	*
BIT-15	*
BIT-16	LSB (NOTE 1)

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

APPLICATION DEPENDENT

Table 11.2-40. Standard Data Word Format, Distance Category Subcategory Nautical Miles (High Range), Single Precision

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: NAUTICAL MILES

SOURCE:	#	MSB: 3276.8	MAX: 6553.6
DESTINATION:	#	LSB: 0.1 (NOTE 1)	MIN: 0
MSG ID:	#	CODING: BNR	SCALE FACTOR: 10
WORD NO.:	#		RESOLUTION: #
MSG-LENGTH:	#		ACCURACY: #
TRANSMISSION RATE:	#		COMPUTATION RATE: #

BIT-01	MSB
BIT-02	*
BIT-03	*
BIT-04	*
BIT-05	*
BIT-06	*
BIT-07	*
BIT-08	*
BIT-09	*
BIT-10	*
BIT-11	*
BIT-12	*
BIT-13	*
BIT-14	*
BIT-15	*
BIT-16	LSB (NOTE 1)

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

APPLICATION DEPENDENT

Table 11.2-41. Standard Data Word Format, Frequency Category, Four-Word Quantity (Sheet 1 of 4)

DOC. NO. #
REV. #
DATE #
PAGE 1 of 4

SIGNAL NAME: #

UNITS: HERTZ

SOURCE:	#	MSB: N/A	MAX: $9999X10^9$(WORD 1)
DESTINATION:	#	LSB: N/A	MIN: 0
MSG ID:	#	CODING: NBCD	SCALE FACTOR: N/A
WORD NO.:	#		RESOLUTION: #
MSG-LENGTH:	#		ACCURACY: #
TRANSMISSION RATE:	#		COMPUTATION RATE: #

BIT-01	MSB	
BIT-02	*	LSB = 1 X 10^{12} Hz (1,000 GHz)
BIT-03	*	
BIT-04	LSB	
BIT-05	MSB	
BIT-06	*	LSB = 1 X 10^{11} Hz (100 GHz)
BIT-07	*	
BIT-08	LSB	
BIT-09	MSB	
BIT-10	*	LSB = 1 X 10^{10} Hz (10 GHz)
BIT-11	*	
BIT-12	LSB	
BIT-13	MSB	
BIT-14	*	LSB = 1 X 10^9 Hz (1 GHz)
BIT-15	*	
BIT-16	LSB	

REMARKS:

APPLICATION DEPENDENT

Table 11.2-41. Standard Data Word Format,
Frequency Category, Four-Word Quantity
(Sheet 2 of 4)

DOC. NO. #
REV. #
DATE #
PAGE 2 of 4

SIGNAL NAME: #

UNITS: HERTZ

SOURCE:	#	MSB: N/A	MAX: $9999X10^5$(WORD 2)
DESTINATION:	#	LSB: N/A	MIN: 0
MSG ID:	#	CODING: NBCD	SCALE FACTOR: N/A
WORD NO.:	#		RESOLUTION: #
MSG-LENGTH:	#		ACCURACY: #
TRANSMISSION RATE:	#		COMPUTATION RATE: #

BIT-01	MSB	
BIT-02	*	LSB = 1 X 10^8 Hz (100 MHz)
BIT-03	*	
BIT-04	LSB	
BIT-05	MSB	
BIT-06	*	LSB = 1 X 10^7 Hz (10 MHz)
BIT-07	*	
BIT-08	LSB	
BIT-09	MSB	
BIT-10	*	LSB = 1 X 10^6 Hz (1 MHz)
BIT-11	*	
BIT-12	LSB	
BIT-13	MSB	
BIT-14	*	LSB = 1 X 10^5 Hz (100 KHz)
BIT-15	*	
BIT-16	LSB	

REMARKS:

APPLICATION DEPENDENT

Table 11.2-41. Standard Data Word Format,
Frequency Category, Four-Word Quantity
(Sheet 3 of 4)

DOC. NO. #
REV. #
DATE #
PAGE 3 of 4

SIGNAL NAME: #

UNITS: HERTZ

SOURCE:	#	MSB: N/A	MAX: 99990 (WORD 3)
DESTINATION:	#	LSB: N/A	MIN: 0
MSG ID:	#	CODING: NBCD	SCALE FACTOR: N/A
WORD NO.:	#		RESOLUTION: #
MSG-LENGTH:	#		ACCURACY: #
TRANSMISSION RATE:	#		COMPUTATION RATE: #

BIT-01	MSB	
BIT-02	*	LSB = 1 X 10^4 Hz (10 KHz)
BIT-03	*	
BIT-04	LSB	
BIT-05	MSB	
BIT-06	*	LSB = 1 X 10^3 Hz (1 KHz)
BIT-07	*	
BIT-08	LSB	
BIT-09	MSB	
BIT-10	*	LSB = 1 X 10^2 Hz (100 Hz)
BIT-11	*	
BIT-12	LSB	
BIT-13	MSB	
BIT-14	*	LSB = 10 Hz
BIT-15	*	
BIT-16	LSB	

REMARKS:

APPLICATION DEPENDENT

Table 11.2-41. Standard Data Word Format, Frequency Category, Four-Word Quantity (Sheet 4 of 4)

DOC. NO. #
REV. #
DATE #
PAGE 4 of 4

SIGNAL NAME: #

UNITS: HERTZ

SOURCE:	#	MSB: N/A	MAX: 9.999 (WORD 4)
DESTINATION:	#	LSB: N/A	MIN: 0
MSG ID:	#	CODING: NBCD	SCALE FACTOR: N/A
WORD NO.:	#		RESOLUTION: #
MSG-LENGTH:	#		ACCURACY: #
TRANSMISSION RATE:	#		COMPUTATION RATE: #

BIT-01	MSB	
BIT-02	#	LSB = 1 Hz
BIT-03	#	
BIT-04	LSB	
BIT-05	MSB	
BIT-06	#	LSB = 1×10^{-1} Hz (0.1 Hz)
BIT-07	#	
BIT-08	LSB	
BIT-09	MSB	
BIT-10	#	LSB = 1×10^{-2} Hz (0.01 Hz)
BIT-11	#	
BIT-12	LSB	
BIT-13	MSB	
BIT-14	#	LSB = 1×10^{-3} Hz (0.001 Hz)
BIT-15	#	
BIT-16	LSB	

REMARKS:

APPLICATION DEPENDENT

Table 11.2-42. Standard Data Word Format, Temperature Category, Subcategory Low Range, Single Precision

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: DEGREES CELSIUS

SOURCE:	#	MSB:	256	MAX:	+512
DESTINATION:	#	LSB:	2E-6 (NOTE 1)	MIN:	-512
MSG ID:	#	CODING:	2's COMPLEMENT	SCALE FACTOR:	64
WORD NO.:	#		INTEGER	RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	SIGN
BIT-02	MSB
BIT-03	*
BIT-04	*
BIT-05	*
BIT-06	*
BIT-07	*
BIT-08	*
BIT-09	*
BIT-10	*
BIT-11	*
BIT-12	*
BIT-13	*
BIT-14	*
BIT-15	*
BIT-16	LSB (NOTE 1)

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

APPLICATION DEPENDENT

Table 11.2-43. Standard Data Word Format, Temperature Category, Subcategory High Range, Single Precision

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: DEGREES CELSIUS

SOURCE:	#	MSB:	1024	MAX:	+2048
DESTINATION:	#	LSB:	2E-4 (NOTE 1)	MIN:	-2048
MSG ID:	#	CODING:	2's COMPLEMENT	SCALE FACTOR:	16
WORD NO.:	#		INTEGER	RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	SIGN
BIT-02	MSB
BIT-03	*
BIT-04	*
BIT-05	*
BIT-06	*
BIT-07	*
BIT-08	*
BIT-09	*
BIT-10	*
BIT-11	*
BIT-12	*
BIT-13	*
BIT-14	*
BIT-15	*
BIT-16	LSB (NOTE 1)

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

APPLICATION DEPENDENT

Table 11.2-44. Standard Data Word Format, Time Category, Subcategory Time of Day, Six-Word Quantity (Sheet 1 of 6)

DOC. NO. #
REV. #
DATE #
PAGE 1 of 6

SIGNAL NAME: #

UNITS: MONTH

SOURCE:	#	MSB:	N/A	MAX:	12
DESTINATION:	#	LSB:	N/A	MIN:	01
MSG ID:	#	CODING:	ASCII-8	SCALE FACTOR:	N/A
WORD NO.:	#			RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	MSB	
BIT-02	*	
BIT-03	*	
BIT-04	*	ASCII-8 ENCODED TENS DIGIT
BIT-05	*	
BIT-06	*	
BIT-07	*	
BIT-08	LSB	
BIT-09	MSB	
BIT-10	*	
BIT-11	*	
BIT-12	*	ASCII-8 ENCODED ONES DIGIT
BIT-13	*	
BIT-14	*	
BIT-15	*	
BIT-16	LSB	

REMARKS:

APPLICATION DEPENDENT

Table 11.2-44. Standard Data Word Format, Time Category, Subcategory Time of Day, Six-Word Quantity (Sheet 2 of 6)

DOC. NO. #
REV. #
DATE #
PAGE 2 of 6

SIGNAL NAME: #

UNITS: DAY

SOURCE:	#	MSB: N/A	MAX: 31
DESTINATION:	#	LSB: N/A	MIN: 01
MSG ID:	#	CODING: ASCII-8	SCALE FACTOR: N/A
WORD NO.:	#		RESOLUTION: #
MSG-LENGTH:	#		ACCURACY: #
TRANSMISSION RATE:	#		COMPUTATION RATE: #

BIT-01	MSB	
BIT-02	*	
BIT-03	*	
BIT-04	*	ASCII-8 ENCODED TENS DIGIT
BIT-05	*	
BIT-06	*	
BIT-07	*	
BIT-08	LSB	
BIT-09	MSB	
BIT-10	*	
BIT-11	*	
BIT-12	*	ASCII-8 ENCODED ONES DIGIT
BIT-13	*	
BIT-14	*	
BIT-15	*	
BIT-16	LSB	

REMARKS:

APPLICATION DEPENDENT

Table 11.2-44. Standard Data Word Format, Time Category, Subcategory Time of Day, Six-Word Quantity (Sheet 3 of 6)

DOC. NO. #
REV. #
DATE #
PAGE 3 of 6

SIGNAL NAME: #

UNITS: HOUR

SOURCE:	#	MSB: N/A	MAX: 23
DESTINATION:	#	LSB: N/A	MIN: 00
MSG ID:	#	CODING: ASCII-8	SCALE FACTOR: N/A
WORD NO.:	#		RESOLUTION: #
MSG-LENGTH:	#		ACCURACY: #
TRANSMISSION RATE:	#		COMPUTATION RATE: #

BIT-01	MSB	
BIT-02	#	
BIT-03	#	
BIT-04	#	ASCII-8 ENCODED TENS DIGIT
BIT-05	#	
BIT-06	#	
BIT-07	#	
BIT-08	LSB	
BIT-09	MSB	
BIT-10	#	
BIT-11	#	
BIT-12	#	ASCII-8 ENCODED ONES DIGIT
BIT-13	#	
BIT-14	#	
BIT-15	#	
BIT-16	LSB	

REMARKS:

APPLICATION DEPENDENT

Table 11.2-44. Standard Data Word Format, Time Category, Subcategory Time of Day, Six-Word Quantity (Sheet 4 of 6)

DOC. NO. #
REV. #
DATE #
PAGE 4 of 6

SIGNAL NAME: #

UNITS: MINUTE

SOURCE:	#	MSB: N/A	MAX: 59
DESTINATION:	#	LSB: N/A	MIN: 00
MSG ID:	#	CODING: ASCII-8	SCALE FACTOR: N/A
WORD NO.:	#		RESOLUTION: #
MSG-LENGTH:	#		ACCURACY: #
TRANSMISSION RATE:	#		COMPUTATION RATE: #

BIT-01	MSB	
BIT-02	*	
BIT-03	*	
BIT-04	*	ASCII-8 ENCODED TENS DIGIT
BIT-05	*	
BIT-06	*	
BIT-07	*	
BIT-08	LSB	
BIT-09	MSB	
BIT-10	*	
BIT-11	*	
BIT-12	*	ASCII-8 ENCODED ONES DIGIT
BIT-13	*	
BIT-14	*	
BIT-15	*	
BIT-16	LSB	

REMARKS:

APPLICATION DEPENDENT

Table 11.2-44. Standard Data Word Format, Time Category, Subcategory Time of Day, Six-Word Quantity (Sheet 5 of 6)

DOC. NO. #
REV. #
DATE #
PAGE 5 of 6

SIGNAL NAME: #

UNITS: SECOND

SOURCE:	#	MSB: N/A		MAX:	59
DESTINATION:	#	LSB: N/A		MIN:	00
MSG ID:	#	CODING: ASCII-8		SCALE FACTOR:	N/A
WORD NO.:	#			RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	MSB	
BIT-02	*	
BIT-03	*	
BIT-04	*	ASCII-8 ENCODED TENS DIGIT
BIT-05	*	
BIT-06	*	
BIT-07	*	
BIT-08	LSB	
BIT-09	MSB	
BIT-10	*	
BIT-11	*	
BIT-12	*	ASCII-8 ENCODED ONES DIGIT
BIT-13	*	
BIT-14	*	
BIT-15	*	
BIT-16	LSB	

REMARKS:

APPLICATION DEPENDENT

Table 11.2-44. Standard Data Word Format, Time Category, Subcategory Time of Day, Six-Word Quantity (Sheet 6 of 6)

DOC. NO. #
REV. #
DATE #
PAGE 6 of 6

SIGNAL NAME: #

UNITS: HUNDRETH (OF SECOND)

SOURCE:	#	MSB: N/A		MAX:	99
DESTINATION:	#	LSB: N/A		MIN:	00
MSG ID:	#	CODING: ASCII-8		SCALE FACTOR:	N/A
WORD NO.:	#			RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	MSB	
BIT-02	*	
BIT-03	*	
BIT-04	*	ASCII-8 ENCODED TENS DIGIT
BIT-05	*	
BIT-06	*	
BIT-07	*	
BIT-08	LSB	
BIT-09	MSB	
BIT-10	*	
BIT-11	*	
BIT-12	*	ASCII-8 ENCODED ONES DIGIT
BIT-13	*	
BIT-14	*	
BIT-15	*	
BIT-16	LSB	

REMARKS:

APPLICATION DEPENDENT

Table 11.2-45. Standard Data Word Format, Velocity Category, Subcategory Feet/Second, Single Precision

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: FEET/SECOND

SOURCE:	#	MSB:	4096	MAX:	+8192
DESTINATION:	#	LSB:	2E-2 (NOTE 1)	MIN:	-8192
MSG ID:	#	CODING:	2's COMPLEMENT	SCALE FACTOR:	4
WORD NO.:	#		INTEGER	RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	SIGN
BIT-02	MSB
BIT-03	*
BIT-04	*
BIT-05	*
BIT-06	*
BIT-07	*
BIT-08	*
BIT-09	*
BIT-10	*
BIT-11	*
BIT-12	*
BIT-13	*
BIT-14	*
BIT-15	*
BIT-16	LSB (NOTE 1)

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

APPLICATION DEPENDENT

Table 11.2-46. Standard Data Word Format, Velocity Category, Subcategory Feet/Second, Double Precision

DOC. NO. #
REV. #
DATE #
Page 1 OF 1

SIGNAL NAME: #

UNITS: FEET/SECOND

SOURCE: #	MSB: 8192	MAX: +16,384
DESTINATION: #	LSB: 2E-17 (NOTE 1)	MIN: -16,384
MSG ID: #	CODING: 2's COMPLEMENT	SCALE FACTOR: 2E17
WORD NO.: #	INTEGER	RESOLUTION: #
MSG-LENGTH: #		ACCURACY: #
TRANSMISSION RATE: #		COMPUTATION RATE: #

WORD 1		WORD 2	
BIT-01	SIGN	BIT-01	*
BIT-02	MSB	BIT-02	*
BIT-03	*	BIT-03	*
BIT-04	*	BIT-04	*
BIT-05	*	BIT-05	*
BIT-06	*	BIT-06	*
BIT-07	*	BIT-07	*
BIT-08	*	BIT-08	*
BIT-09	*	BIT-09	*
BIT-10	*	BIT-10	*
BIT-11	*	BIT-11	*
BIT-12	*	BIT-12	*
BIT-13	*	BIT-13	*
BIT-14	*	BIT-14	*
BIT-15	*	BIT-15	*
BIT-16	*	BIT-16	LSB (NOTE 1)

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

APPLICATION DEPENDENT

Table 11.2-47. Standard Data Word Format, Velocity Category, Subcategory Meters/Second, Double Precision

DOC. NO. #
REV. #
DATE #
Page 1 OF 1

SIGNAL NAME: #

UNITS: METERS/SECOND

SOURCE:	#	MSB:	4096	MAX:	+8192
DESTINATION:	#	LSB:	3.81E-6	MIN:	-8192
MSG ID:	#	CODING:	2'S COMPLEMENT	SCALE FACTOR:	2E18
WORD NO.:	#		INTEGER	RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

WORD 1		WORD 2	
BIT-01	SIGN	BIT-01	*
BIT-02	MSB	BIT-02	*
BIT-03	*	BIT-03	*
BIT-04	*	BIT-04	*
BIT-05	*	BIT-05	*
BIT-06	*	BIT-06	*
BIT-07	*	BIT-07	*
BIT-08	*	BIT-08	*
BIT-09	*	BIT-09	*
BIT-10	*	BIT-10	*
BIT-11	*	BIT-11	*
BIT-12	*	BIT-12	*
BIT-13	*	BIT-13	*
BIT-14	*	BIT-14	*
BIT-15	*	BIT-15	*
BIT-16	* (NOTE 1)	BIT-16	LSB

REMARKS:

NOTE 1: IF A RESOLUTION FINER THAN 0.25 M/SEC. IS REQUIRED, USE WORDS 1 AND 2. IF A RESOLUTION OF 0.25 M/SEC. OR COARSER IS REQUIRED, USE ONLY WORD 1. THE LSB (BIT 16) OF WORD 1 IS EQUAL TO 1 KILOMETER

APPLICATION DEPENDENT

Table 11.2-48. Standard Data Word Format, Velocity Category, Subcategory Knots, Single Precision

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: KNOTS

SOURCE:	#	MSB:	4096	MAX:	8192
DESTINATION:	#	LSB:	2E-3 (NOTE 1)	MIN:	0
MSG ID:	#	CODING:	BNR	SCALE FACTOR:	8
WORD NO.:	#			RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	MSB
BIT-02	#
BIT-03	#
BIT-04	#
BIT-05	#
BIT-06	#
BIT-07	#
BIT-08	#
BIT-09	#
BIT-10	#
BIT-11	#
BIT-12	#
BIT-13	#
BIT-14	#
BIT-15	#
BIT-16	LSB (NOTE 1)

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

APPLICATION DEPENDENT

Table 11.2-49. Standard Data Word Format, Velocity Category, Subcategory Mach, Single Precision

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: MACH

SOURCE:	#	MSB:	16	MAX:	32
DESTINATION:	#	LSB:	2E-11 (NOTE 1)	MIN:	0
MSG ID:	#	CODING:	BNR	SCALE FACTOR:	2E11
WORD NO.:	#			RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	MSB
BIT-02	*
BIT-03	*
BIT-04	*
BIT-05	*
BIT-06	*
BIT-07	*
BIT-08	*
BIT-09	*
BIT-10	*
BIT-11	*
BIT-12	*
BIT-13	*
BIT-14	*
BIT-15	*
BIT-16	LSB (NOTE 1)

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

APPLICATION DEPENDENT

Table 11.2-50. Standard Data Word Format, Voltage Category, Subcategory High Range, Single Precision

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: VOLTS

SOURCE:	#	MSB:	256	MAX:	+512
DESTINATION:	#	LSB:	2E-6 (NOTE 1)	MIN:	-512
MSG ID:	#	CODING:	2's COMPLEMENT	SCALE FACTOR:	64
WORD NO.:	#		INTEGER	RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	SIGN
BIT-02	MSB
BIT-03	*
BIT-04	*
BIT-05	*
BIT-06	*
BIT-07	*
BIT-08	*
BIT-09	*
BIT-10	*
BIT-11	*
BIT-12	*
BIT-13	*
BIT-14	*
BIT-15	*
BIT-16	LSB (NOTE 1)

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

APPLICATION DEPENDENT

Table 11.2-51. Standard Data Word Format, Voltage Category, Subcategory Mid Range, Single Precision

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: VOLTS

SOURCE:	#	MSB:	16	MAX:	+32
DESTINATION:	#	LSB:	2E-10 (NOTE 1)	MIN:	-32
MSG ID:	#	CODING:	2's COMPLEMENT	SCALE FACTOR:	1024
WORD NO.:	#		INTEGER	RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	SIGN
BIT-02	MSB
BIT-03	*
BIT-04	*
BIT-05	*
BIT-06	*
BIT-07	*
BIT-08	*
BIT-09	*
BIT-10	*
BIT-11	*
BIT-12	*
BIT-13	*
BIT-14	*
BIT-15	*
BIT-16	LSB (NOTE 1)

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

APPLICATION DEPENDENT

Table 11.2-52. Standard Data Word Format, Voltage Category, Subcategory Low (Millivolt) Range, Single Precision

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: VOLTS

SOURCE:	#	MSB:	1/8	MAX:	+1/4
DESTINATION:	#	LSB:	2E-17 (NOTE 1)	MIN:	-1/4
MSG ID:	#	CODING:	2's COMPLEMENT	SCALE FACTOR:	4
WORD NO.:	#		FRACTIONAL	RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	#
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	SIGN
BIT-02	MSB
BIT-03	#
BIT-04	#
BIT-05	#
BIT-06	#
BIT-07	#
BIT-08	#
BIT-09	#
BIT-10	#
BIT-11	#
BIT-12	#
BIT-13	#
BIT-14	#
BIT-15	#
BIT-16	LSB (NOTE 1)

REMARKS:

NOTE 1: THE LSB VALUE AND LOCATION MAY BE CHANGED, AS REQUIRED, TO ADJUST RESOLUTION OF DATA WORD FORMAT. ANY BITS AFTER LSB MUST BE SET TO ZERO.

APPLICATION DEPENDENT

Table 11.2-53. Standard Data Word Format, Communications Category, Channel Select Subcategory

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: N/A

SOURCE:	#	MSB:	N/A	MAX:	N/A
DESTINATION:	#	LSB:	N/A	MIN:	N/A
MSG ID:	#	CODING:	NBCD	SCALE FACTOR:	N/A
WORD NO.:	#			RESOLUTION:	N/A
MSG-LENGTH:	#			ACCURACY:	N/A
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	MSB	
BIT-02	*	THOUSANDS (0-9)
BIT-03	*	
BIT-04	LSB	
BIT-05	MSB	
BIT-06	*	HUNDREDS (0-9)
BIT-07	*	
BIT-08	LSB	NOTE 1
BIT-09	MSB	
BIT-10	*	TENS (0-9)
BIT-11	*	
BIT-12	LSB	
BIT-13	MSB	
BIT-14	*	ONES (0-9)
BIT-15	*	
BIT-16	LSB	

REMARKS:

NOTE 1 - RADIO CHANNEL NUMBER

APPLICATION DEPENDENT

Table 11.2-54. Standard Data Word Format,
Communications Category,
Radio Selection Subcategory

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: N/A

SOURCE: #	MSB: N/A	MAX:	N/A
DESTINATION: #	LSB: N/A	MIN:	N/A
MSG ID: #	CODING: DISCRETES	SCALE FACTOR:	N/A
WORD NO.: #		RESOLUTION:	N/A
MSG-LENGTH: #		ACCURACY:	N/A
TRANSMISSION RATE: #		COMPUTATION RATE:	#

BIT-01	R1	
BIT-02	R2	
BIT-03	R3	
BIT-04	R4	
BIT-05	R5	
BIT-06	R6	
BIT-07	R7	RADIO SELECT DISCRETES
BIT-08	R8	NOTE 1
BIT-09	R9	
BIT-10	R10	
BIT-11	R11	
BIT-12	R12	
BIT-13	R13	
BIT-14	R14	
BIT-15	R15	
BIT-16	R16	

REMARKS:

NOTE 1 - DISCRETES FOR RADIO SELECTION. LOGIC "ONE" IS SELECTED; LOGIC "ZERO" IS DESELECTED.

- APPLICATION DEPENDENT

Table 11.2-55. Standard Data Word Format, Data Validity Category, Checksum Subcategory

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: N/A

SOURCE:	#	MSB:	N/A	MAX:	N/A
DESTINATION:	#	LSB:	N/A	MIN:	N/A
MSG ID:	#	CODING:	BNR	SCALE FACTOR:	N/A
WORD NO.:	#			RESOLUTION:	N/A
MSG-LENGTH:	#			ACCURACY:	N/A
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	MSB	
BIT-02	*	
BIT-03	*	
BIT-04	*	
BIT-05	*	
BIT-06	*	CHECKSUM WORD
BIT-07	*	
BIT-08	*	NOTE 1
BIT-09	*	
BIT-10	*	
BIT-11	*	
BIT-12	*	
BIT-13	*	
BIT-14	*	
BIT-15	*	
BIT-16	LSB	

REMARKS:

NOTE 1 - THE CHECKSUM WORD CONSISTS OF THE ARITHMETIC SUM, WITHOUT REGARD TO OVERFLOWS, OF A SELECTED GROUP OF DATA WORDS. MORE THAN ONE CHECKSUM WORD CAN BE USED, IF REQUIRED.

APPLICATION DEPENDENT

Table 11.2-56. Standard Data Word Format, Data Validity Category, Cyclic Redundancy Check Subcategory

DOC. NO. #
REV. #
DATE #
Page 1 OF 1

SIGNAL NAME: #

UNITS: N/A

SOURCE:	#	MSB:	N/A	MAX:	N/A
DESTINATION:	#	LSB:	N/A	MIN:	N/A
MSG ID:	#	CODING:	BINARY (CRC)	SCALE FACTOR:	N/A
WORD NO.:	#			RESOLUTION:	N/A
MSG-LENGTH:	#			ACCURACY:	N/A
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

WORD 1			WORD 2		
BIT-01	MSB		BIT-01	#	
BIT-02	#		BIT-02	#	
BIT-03	#		BIT-03	#	
BIT-04	#		BIT-04	#	
BIT-05	#		BIT-05	#	
BIT-06	#		BIT-06	#	
BIT-07	#	NOTE 1	BIT-07	#	NOTE 1
BIT-08	#		BIT-08	#	
BIT-09	#		BIT-09	#	
BIT-10	#		BIT-10	#	
BIT-11	#		BIT-11	#	
BIT-12	#		BIT-12	#	
BIT-13	#		BIT-13	#	
BIT-14	#		BIT-14	#	
BIT-15	#		BIT-15	#	
BIT-16	#		BIT-16	LSB	

REMARKS:

NOTE 1 - THE NUMBER OF BITS REQUIRED WILL DEPEND ON:

a) NUMBER OF WORDS IN GROUP CHOSEN FOR ERROR DETECTION/CORRECTION
b) NUMBER OF ERRORS REQUIRED TO BE DETECTED/CORRECTED
c) PROBABILITY OF DETECTION REQUIRED

IF ALL 32 BITS ARE NOT REQUIRED, THE MOST SIGNIFICANT PART SHOULD BE USED AND UNUSED BITS SHOULD BE SET TO ZERO. IF 16 BITS OR LESS IS REQUIRED, USE ONLY WORD 1.

- APPLICATION DEPENDENT

Table 11.2-57. Standard Data Word Format, Data Validity Category, Validity Bit Subcategory

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: N/A

SOURCE:	#	MSB:	N/A	MAX:	N/A
DESTINATION:	#	LSB:	N/A	MIN:	N/A
MSG ID:	#	CODING:	DISCRETE	SCALE FACTOR:	N/A
WORD NO.:	#			RESOLUTION:	N/A
MSG-LENGTH:	#			ACCURACY:	N/A
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	MSB
BIT-02	*
BIT-03	*
BIT-04	*
BIT-05	*
BIT-06	*
BIT-07	*
BIT-08	*
BIT-09	*
BIT-10	*
BIT-11	*
BIT-12	*
BIT-13	*
BIT-14	*
BIT-15	LSB
BIT-16	V - (VALIDITY BIT) NOTE 1

REMARKS:

NOTE 1: - V = 0 - DATA WORD VALID

V = 1 - DATA WORD INVALID

THE VALIDITY BIT MAY BE PLACED IN BIT POSITION 16 OF ANY SELECTED DATA WORD.

APPLICATION DEPENDENT

Table 11.2-58. Standard Data Word Format, Display Data Category, Character Display Subcategory

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: N/A

SOURCE:	#	MSB:	N/A	MAX:	N/A
DESTINATION:	#	LSB:	N/A	MIN:	N/A
MSG ID:	#	CODING:	ASCII-8 (NOTE 1)	SCALE FACTOR:	N/A
WORD NO.:	#			RESOLUTION:	N/A
MSG-LENGTH:	#			ACCURACY:	N/A
TRANSMISSION RATE:	#			COMPUTATION RATE:	N/A

BIT-01	MSB	
BIT-02	*	
BIT-03	*	FIRST CHARACTER
BIT-04	*	
BIT-05	*	
BIT-06	*	
BIT-07	*	
BIT-08	LSB	
BIT-09	MSB	
BIT-10	*	
BIT-11	*	
BIT-12	*	SECOND CHARACTER
BIT-13	*	
BIT-14	*	
BIT-15	*	
BIT-16	LSB	

REMARKS:

NOTE 1 - IF STANDARD 7-BIT ASCII IS USED, THE FIRST BIT OF EACH CHARACTER FIELD SHALL BE SET TO LOGIC ZERO (0), AND THE 7-BIT ASCII CODE SHALL OCCUPY THE REMAINING SEVEN BITS OF THE FIELD.

APPLICATION DEPENDENT

Table 11.2-59. Standard Data Word Format, Header Word Category, Message Header Subcategory

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: N/A

SOURCE:	#	MSB: N/A	MAX: N/A
DESTINATION:	#	LSB: N/A	MIN: N/A
MSG ID:	#	CODING: BINARY (CODED)	SCALE FACTOR: N/A
WORD NO.:	#		RESOLUTION: N/A
MSG-LENGTH:	#		ACCURACY: N/A
TRANSMISSION RATE:	#		COMPUTATION RATE: #

BIT-01	MSB	
BIT-02	*	
BIT-03	*	
BIT-04	*	
BIT-05	*	
BIT-06	*	MESSAGE ID
BIT-07	*	NOTE 1
BIT-08	*	
BIT-09	*	
BIT-10	*	
BIT-11	LSB	
BIT-12	MSB	
BIT-13	*	
BIT-14	*	WORD COUNT
BIT-15	*	NOTE 2
BIT-16	LSB	

REMARKS:

NOTE 1: MESSAGE ID MAY BE USED TO DESIGNATE SIGNIFICANT INFORMATION; EITHER MESSAGE NUMBER, TYPE, SUBSYSTEM OPERATING MODE OR OTHER FEATURES.

NOTE 2: WORD COUNT MAY BE USED TO DESIGNATE THE NUMBER OF SIGNIFICANT WORDS ASSOCIATED WITH THE MESSAGE, UP TO A MAXIMUM OF 32. THIS NUMBER MAY OR MAY NOT BE THE SAME AS THE 1553 COMMAND WORD COUNT FIELD.

APPLICATION DEPENDENT

Table 11.2-60. Standard Data Word Format, Navigation Category, Convergence Factor Subcategory

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: N/A

SOURCE:	#	MSB: 1	MAX: 2
DESTINATION:	#	LSB: 2E-15	MIN: 0
MSG ID:	#	CODING: BNR	SCALE FACTOR: 2E-15
WORD NO.:	#		RESOLUTION: #
MSG-LENGTH:	#		ACCURACY: #
TRANSMISSION RATE:	#		COMPUTATION RATE: #

BIT-01	MSB
BIT-02	*
BIT-03	*
BIT-04	*
BIT-05	*
BIT-06	*
BIT-07	*
BIT-08	*
BIT-09	*
BIT-10	*
BIT-11	*
BIT-12	*
BIT-13	*
BIT-14	*
BIT-15	*
BIT-16	LSB

REMARKS:

APPLICATION DEPENDENT

Table 11.2-61. Standard Data Word Format, Navigation Category, Direction Cosine Subcategory, Platform to Earth Coordinates

DOC. NO. #
REV. #
DATE #
Page 1 OF 1

SIGNAL NAME: # (NOTE 1)

UNITS: N/A

SOURCE:	#	MSB:	1/2	MAX:	+1
DESTINATION:	#	LSB:	2E-23	MIN:	-1
MSG ID:	#	CODING:	2's COMPLEMENT	SCALE FACTOR:	1
WORD NO.:	#		FRACTIONAL	RESOLUTION:	#
MSG-LENGTH:	#			ACCURACY:	N/A
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

WORD 1		WORD 2	
BIT-01	SIGN	BIT-01	*
BIT-02	MSB	BIT-02	*
BIT-03	*	BIT-03	*
BIT-04	*	BIT-04	*
BIT-05	*	BIT-05	*
BIT-06	*	BIT-06	*
BIT-07	*	BIT-07	*
BIT-08	*	BIT-08	LSB
BIT-09	*	BIT-09	0
BIT-10	*	BIT-10	0
BIT-11	*	BIT-11	0
BIT-12	*	BIT-12	0
BIT-13	*	BIT-13	0
BIT-14	*	BIT-14	0
BIT-15	*	BIT-15	0
BIT-16	*	BIT-16	0

REMARKS:

NOTE 1 - A. THE DIRECTION COSINES (CXX, CXY, CXZ) ARE PLATFORM TO EARTH COORDINATES WHICH, WITH LONGITUDE, DEFINE THE LOCATIONS OF THE AIRCRAFT RELATIVE TO THE EARTH. THESE COSINES CAN BE EXPRESSED AS:

CXX = COSINE γ COSINE a
CXY = -COSINE γ SIN a
CXZ = + SIN γ
WHERE γ = LATITUDE, AND a = WANDER ANGLE

B. SIX DATA WORDS ARE REQUIRED TO DEFINE THE DIRECTION COSINES.

APPLICATION DEPENDENT

Table 11.2-62. Standard Data Word Format, Navigation Category, Direction Cosine Subcategory, Aircraft Body Coordinates (Sheet 1 of 2)

DOC. NO. #
REV. #
DATE #
PAGE 1 of 2

SIGNAL NAME: # (SEE NOTE 1)

UNITS: N/A

SOURCE:	#	MSB: 1/2	MAX: +1
DESTINATION:	#	LSB: 2E-15	MIN: -1
MSG ID:	#	CODING: 2's COMPLEMENT	SCALE FACTOR: 1
WORD NO.:	#	FRACTIONAL	RESOLUTION: #
MSG-LENGTH:	#		ACCURACY: #
TRANSMISSION RATE:	#		COMPUTATION RATE: #

BIT-01	SIGN
BIT-02	MSB
BIT-03	*
BIT-04	*
BIT-05	*
BIT-06	*
BIT-07	*
BIT-08	*
BIT-09	*
BIT-10	*
BIT-11	*
BIT-12	*
BIT-13	*
BIT-14	*
BIT-15	*
BIT-16	LSB

REMARKS:

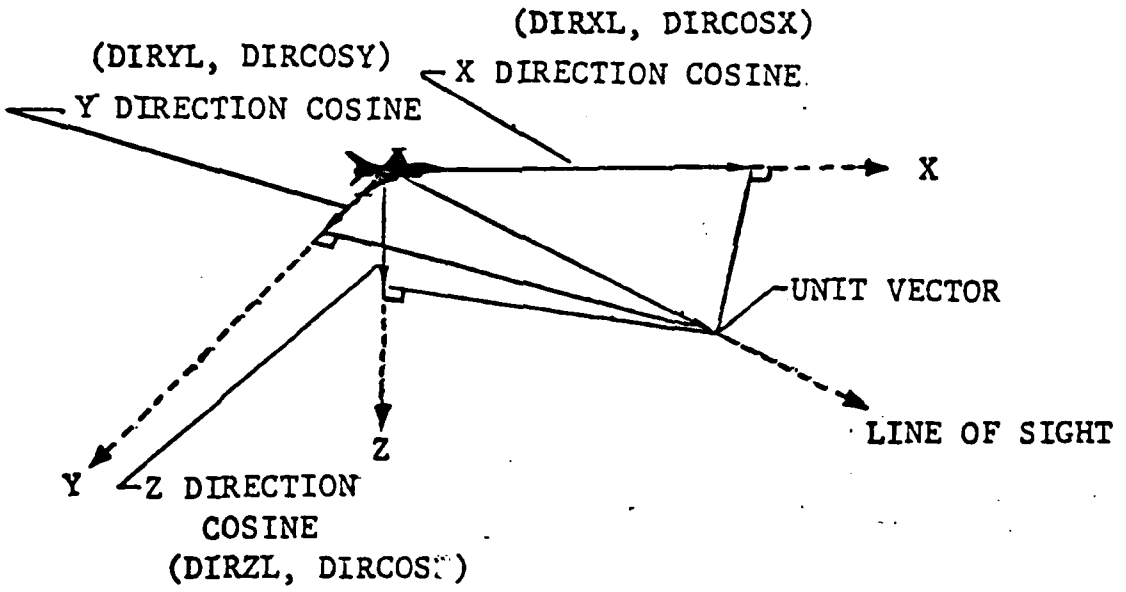
NOTE 1 - THE DIRECTION COSINES (DIRXL, DIRCOSX, DIRYL, DIRCOSY, DIRZL, DIRCOSZ) AIRCRAF BODY COODINATES. THREE DATA WORDS ARE REQUIRED TO DEFINE THE DIRECTION COSINE THE DEFINITION OF THE AIRCRAFT COORDINATE SYSTEM IS CONTAINED ON PAGE 2.

APPLICATION DEPENDENT

Table 11.2-62. Standard Data Word Format, Navigation Category, Direction Cosine Subcategory, Aircraft Body Coordinates (Sheet 2 of 2)

SIGNAL NAME: # (SEE NOTE 1)

NOTE 1 - (CONTINUED)



X IS PARALLEL TO FUSELAGE REFERENCE LINE (INTERSECTION OF A/C BUTTOCK LINE AND WATER LINE PLANES) (POSITIVE FORWARD)

Y IS PERPENDICULAR TO A/C BUTTOCK LINE PLANE (POSITIVE TO PILOT'S RIGHT)

Z IS PERPENDICULAR TO A/C WATER LINE PLANE (POSITIVE DOWN)

DIRECTION COSINES ARE POSITIVE AS SHOWN ABOVE

AIRCRAFT BODY COORDINATE SYSTEM DEFINITION

Table 11.2-63. Standard Data Word Format, Navigation Category, 100,000-Meter Grid Zone Subcategory

DOC. NO. #
REV. #
DATE #
Page 1 OF 1

SIGNAL NAME: #

UNITS: N/A

SOURCE: #	MSB: N/A	MAX:	N/A
DESTINATION: #	LSB: N/A	MIN:	N/A
MSG ID: #	CODING: ASCII	SCALE FACTOR:	N/A
WORD NO.: #		RESOLUTION:	N/A
MSG-LENGTH: #		ACCURACY:	N/A
TRANSMISSION RATE: #		COMPUTATION RATE:	#

BIT-01	MSB	
BIT-02	*	
BIT-03	*	UTM AREA (MSC)
BIT-04	*	NOTE 1
BIT-05	*	
BIT-06	*	
BIT-07	LSB	
BIT-08	0	
BIT-09	MSB	
BIT-10	*	
BIT-11	*	UTM AREA (LSC)
BIT-12	*	NOTE 1
BIT-13	*	
BIT-14	*	
BIT-15	LSB	
BIT-16	0	

REMARKS:

NOTE 1: THE ORDER OF THE ALPHA (A-Z) CHARACTERS DESIGNATING THE 100,000 METER GRID ZONE IS COLUMN FIRST AND THEN ROW. MSC IS MOST SIGNIFICANT CHARACTER AND LSC IS LEAST SIGNIFICANT CHARACTER.

Table 11.2-64. Standard Data Word Format, Navigation Category, Spheroid/UTM Grid Zone Subcategory

DOC. NO. #
REV. #
DATE #
Page 1 OF 1

SIGNAL NAME: #

UNITS: N/A

SOURCE:	#	MSB:	N/A	MAX:	N/A
DESTINATION:	#	LSB:	N/A	MIN:	N/A
MSG ID:	#	CODING:	ASCII	SCALE FACTOR:	N/A
WORD NO.:	#			RESOLUTION:	N/A
MSG-LENGTH:	#			ACCURACY:	N/A
TRANSMISSION RATE:	#			COMPUTATION RATE:	N/A

WORD 1 (MSP) NOTE 3			WORD 2 (LSP) NOTE 3		
BIT-01	MSB		BIT-01	MSB	
BIT-02	*		BIT-02	*	
BIT-03	*	SPHEROID MODEL	BIT-03	*	UTM GRID ZONE
BIT-04	*	NOTE 1	BIT-04	*	
BIT-05	*		BIT-05	*	
BIT-06	*		BIT-06	*	
BIT-07	LSB		BIT-07	LSB	
BIT-08	0		BIT-08	0	
BIT-09	MSB		BIT-09	MSB	
BIT-10	*		BIT-10	*	
BIT-11	*	UTM GRID ZONE	BIT-11	*	UTM GRID ZONE
BIT-12	*	NOTE 2 (MSC)	BIT-12	*	NOTE 2 (LSC)
BIT-13	*		BIT-13	*	
BIT-14	*		BIT-14	*	
BIT-15	LSB		BIT-15	LSB	
BIT-16	0		BIT-16	0	

REMARKS:

NOTE 1 - SPHEROID MODEL CODES

MODEL	ASCII CODE	BINARY
INTERNATIONAL	0	0110000
CLARK 1866	1	0110001
CLARK 1880	2	0110010
EVEREST	3	0110011
BESSEL	4	0110100
AUSTRALIAN NAT.	5	0110101
AIRY	6	0110110
HOUGH	7	0110111
SOUTH AMERICAN	8	0111000
MODIFIED EVEREST	9	0111001
WGS 72	A	1000001

NOTE 2 - THE ORDER OF CHARACTERS DESIGNATING UTM GRID ZONE IS COLUMN FIRST AND THEN ROW. MSC IS MOST SIGNIFICANT CHARACTER AND LSC IS LEAST SIGNIFICANT CHARACTER.

NOTE 3 - MSP IS MOST SIGNIFICANT PART AND LSP IS LEAST SIGNIFICANT PART

- APPLICATION DEPENDENT

Table 11.2-65. Standard Data Word Format, Stores Management Category, Laser Code Subcategory

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: N/A

SOURCE:	#	MSB:	N/A	MAX:	N/A
DESTINATION:	#	LSB:	N/A	MIN:	N/A
MSG ID:	#	CODING:	BINARY (OCTAL)	SCALE FACTOR:	N/A
WORD NO.:	#			RESOLUTION:	N/A
MSG-LENGTH:	#			ACCURACY:	N/A
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	MSB	
BIT-02	*	(0-7) MSP
BIT-03	LSB	
BIT-04	MSB	
BIT-05	*	(0-7)
BIT-06	LSB	
BIT-07	MSB	
BIT-08	*	(0-7)
BIT-09	LSB	
BIT-10	MSB	
BIT-11	*	(0-7) LSP
BIT-12	LSB	
BIT-13	0	
BIT-14	0	
BIT-15	0	
BIT-16	0	

REMARKS:

MSP - IS MOST SIGNIFICANT PART
LSP - IS LEAST SIGNIFICANT PART

- APPLICATION DEPENDENT

Table 11.2-66. Standard Data Word Format, Stores Management Category, Release Command Code Subcategory

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: N/A

SOURCE:	#	MSB:	N/A	MAX:	N/A
DESTINATION:	#	LSB:	N/A	MIN:	N/A
MSG ID:	#	CODING:	DISCRETE FIXED	SCALE FACTOR:	N/A
WORD NO.:	#		BIT PATTERN	RESOLUTION:	N/A
MSG-LENGTH:	#			ACCURACY:	N/A
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	R	
BIT-02	R	
BIT-03	R	
BIT-04	R	
BIT-05	R	
BIT-06	R	
BIT-07	R	RELEASE CODE
BIT-08	R	NOTE 1
BIT-09	R	
BIT-10	R	
BIT-11	R	
BIT-12	R	
BIT-13	R	
BIT-14	R	
BIT-15	R	
BIT-16	R	

REMARKS:

NOTE 1 - IF ALL 16 BITS NOT USED, PLACE PATTERN IN MOST SIGNIFICANT PART OF WORD AND SET UNUSED BITS TO ZERO.

\# - APPLICATION DEPENDENT

Table 11.2-67. Standard Data Word Format, Stores Management Category, Store Inventory Subcategory

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: N/A

SOURCE:	#	MSB: N/A		MAX:	N/A
DESTINATION:	#	LSB: N/A		MIN:	N/A
MSG ID:	#	CODING:	BNR (NOTE 2)	SCALE FACTOR:	N/A
WORD NO.:	#		DISCRETE CODES	RESOLUTION:	N/A
MSG-LENGTH:	#		(NOTES 1 AND 3)	ACCURACY:	N/A
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	R	
BIT-02	R	
BIT-03	R	
BIT-04	R	WEAPON/RACK ID
BIT-05	R	NOTE 1
BIT-06	R	
BIT-07	R	
BIT-08	R	
BIT-09	MSB	
BIT-10	*	WEAPONS QTY.
BIT-11	*	NOTE 2
BIT-12	LSB	
BIT-13	R	
BIT-14	R	STATION ID
BIT-15	R	NOTE 3
BIT-16	R	

REMARKS:

NOTE 1 - CODED WEAPON/RACK TYPE

NOTE 2 - QUANTITY OF WEAPONS REMAINING

NOTE 3 - STATION LOCATION OF WEAPON/RACK

- APPLICATION DEPENDENT

Table 11.2-68. Standard Data Word Format, Stores Management Category, Station/Store Status Subcategory

DOC. NO. #
REV. #
DATE #
Page 1 OF 1

SIGNAL NAME: #

UNITS: N/A

SOURCE:	#	MSB: N/A		MAX:	N/A
DESTINATION:	#	LSB: N/A		MIN:	N/A
MSG ID:	#	CODING:	DISCRETES (WORD 1)	SCALE FACTOR:	N/A
WORD NO.:	#		DISCRETES (CODED)	RESOLUTION:	N/A
MSG-LENGTH:	#		(WORD 2)	ACCURACY:	N/A
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

WORD 1			WORD 2		
BIT-01	STA-1		BIT-01	R	
BIT-02	STA-2		BIT-02	R	
BIT-03	STA-3		BIT-03	R	
BIT-04	STA-4		BIT-04	R	STORE ID
BIT-05	STA-5	STATION FAILED	BIT-05	R	NOTE 2
BIT-06	STA-6	NOTE 1	BIT-06	R	
BIT-07	STA-7		BIT-07	R	
BIT-08	STA-8		BIT-08	R	
BIT-09	STA-9		BIT-09	R	
BIT-10	STA-10		BIT-10	R	STORE
BIT-11	STA-11		BIT-11	R	POSITION
BIT-12	STA-12		BIT-12	R	NOTE 3
BIT-13	STA-13		BIT-13	R	
BIT-14	STA-14		BIT-14	R	
BIT-15	STA-15		BIT-15	R	STATION ID
BIT-16	STA-16		BIT-16	R	

REMARKS:

NOTE 1: STATION FAILURE = 1 - INDICATES THAT FAILURE HAS OCCURRED AT STATION INDICATED. FAILURE MAY BE IN STATION EQUIPMENT OR STORE. IF ALL 16 POSITIONS NOT REQUIRED, USE MOST SIGNIFICANT PART OF WORD AND SET UNUSED BITS TO ZERO.

NOTE 2: IDENTIFIES FAILED STORE (REF. STORE CODE TABLE).

NOTE 3: IDENTIFIES FAILED STORE POSITION AT SELECTED STATION.

- APPLICATION DEPENDENT

Table 11.2-69. Standard Data Word Format, Stores Management Category, Weapon Selection (ID/QTY) Subcategory

DOC. NO. #
REV. #
DATE #
PAGE 1 of 1

SIGNAL NAME: #

UNITS: N/A

SOURCE:	#	MSB: N/A		MAX:	N/A
DESTINATION:	#	LSB: N/A		MIN:	N/A
MSG ID:	#	CODING:	BNR (NOTE 2)	SCALE FACTOR:	N/A
WORD NO.:	#		DISCRETES (CODED)	RESOLUTION:	N/A
MSG-LENGTH:	#		(NOTES 1 & 3)	ACCURACY:	N/A
TRANSMISSION RATE:	#			COMPUTATION RATE:	#

BIT-01	R	
BIT-02	R	
BIT-03	R	
BIT-04	R	WEAPON ID
BIT-05	R	NOTE 1
BIT-06	R	
BIT-07	R	
BIT-08	R	
BIT-09	MSB	
BIT-10	*	WEAPON QTY
BIT-11	*	NOTE 2
BIT-12	LSB	
BIT-13	R	
BIT-14	R	STATION ID
BIT-15	R	NOTE 3
BIT-16	R	

REMARKS:

NOTE 1: CODED WEAPONS TYPE (REF. TABLE)

NOTE 2: QUANTITY OF WEAPONS REMAINING FOR WEAPONS TYPE DESIGNATED BY WEAPONS ID.

NOTE 3: STATION SELECTED ID (1-16)

- APPLICATION DEPENDENT

11.3 Message Formats

Message is defined in MIL-STD-1553B as the transmission of a command word, status word, and data words if they are specified. For the RT-to-RT transmission, the message definition is expanded to include the two command words, the two status words, and the data words. In chapter 8, page 8-3, of this MUX Handbook, a message is defined to be the data words (1-32) that are part of the information transfer format. The information transfer format is defined the same as 1553B message definition. For purposes of the discussion to follow, message format is defined to mean the order and content of the data words within the information transfer formats shown in figures 6 and 7 of MIL-STD-1553B.

The general rules for message construction and recommended standard messages for certain subsystems are included in this section. Selection of the standard messages was based on an analysis of INU, ADC, radar altimeter, and GPS subsystem output messages contained in the word format data base.

11.3.1 General Rules for Message Construction

The following is a list of general rules for message construction developed from the message format analysis, common usage, and good engineering practice.

1. Multiple messages from a subsystem containing the same data words should have those data words in the same position and order.

2. Shorter messages, which contain some of the data words found in a longer message, should be a subset of the longer message with the same data word positions.

3. A header word may be provided as the first word of the message. The header may contain message ID, subsystem mode and status information, and word count. A standard header word format is contained in table 11.2-59.

4. Use standard data words, defined in paragraph 11.2.5, whenever possible.

5. When initially assigning words to messages, leave space for later expansion. In other words, do not assign all 32 word spaces in the beginning. A recommended maximum number of words to be assigned initially is 28.

   When assigning words to messages, do not program in spare or reserved words. This has been done in the past by assigning word positions with all zeros (no data) for expansion purposes.

6. The use of built-in-test (BIT) status words is encouraged.

   When a BIT status word is used, it should be placed immediately after the message header word, if one is used. If a message header word is not used, the BIT status word should be the first word in the message.

7. Investigate the data interface and processing requirements of the destination subsystem, and construct source messages for efficient data processing at the receiving subsystem.

11.3.2 Recommended Standard Messages

Recommended standard message formats have been developed by analyzing the INU, ADC, radar altimeter, and GPS subsystems. These messages resulted from message analyses that compared subsystem output messages for commonality within the system (F-16, F^{3}INS, A-10 INS, LAMPS, GPS, and B-52 OAS) and between systems. The message analysis made use of the data base developed for the word format analysis. Standard messages were developed for the INU, ADC, and radar altimeter subsystems. No standard message was determined for GPS because of the wide disparity between existing messages.

The standard messages are listed below, and are defined in detail in the tables referenced.

Subsystem	Message ID	Number of Words	Table No.
INU	I01	29	11.3-1
INU	I02	10	11.3-2
ADC	C01	23	11.3-3
Radar Altimeter	A01	3	11.3-4

Table 11.3-1. Recommended Inertial Navigation Unit (INU) Standard Message - I01

Message ID - I01

Word No.	Signal Name	Standard Word Table No.
01	INU Header Word	11.2-59
02	Time Tag	None
03-08	Velocity x, y, z	11.2-46
09	Platform Azimuth	11.2-30
10, 11	Roll, Pitch	11.2-30
12	True Heading	11.2-30
13	Magnetic Heading	11.2-30
14-16	Acceleration x, y, z	11.2-28
17-22	Direction Cosines (Cxx, Cxy, Cxz)	11.2-61
23, 24	Longitude	11.2-31
25, 26	Inertial Altitude	11.2-35
27	Computed Course Deviation	11.2-30
28	X-Axis Residual Tilt	11.2-32
29	Y-Axis Residual Tilt	11.2-32

AD-A121 934 MIL-STD-1553 MULTIPLEX DATA BUS WORD FORMATS(U) BOEING 2/2
MILITARY AIRPLANE CO SEATTLE WA DEC 81
F33615-80-C-0124

UNCLASSIFIED F/G 9/2 NL

END

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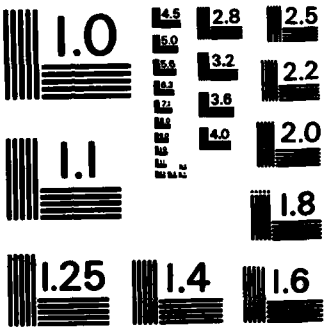

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Table 11.3-2. Recommended Inertial Navigation Unit (INU) Standard Message - I02

Message ID - I02

Word No.	Signal Name	Standard Word Table No.
01	INU Header Word	11.2-59
02, 03	INU BITE Summary Word 1 & 2	None
04, 05	Alpha Display Characters	11.2-58
06	Alpha Display Discretes	None
07, 08	Left Misc. Display	11.2-58
09, 10	Right Misc. Display	11.2-58

Table 11.3-3. Recommended Air Data Computer Standard Message

Message ID - C01

Word No.	Signal Name	Standard Word Table No.
01	ADC Header Word	11.2-59
02	ADC BIT Status Word	None
03, 04	Pressure Altitude	11.2-35
05, 06	Baro Ref. Altitude	11.2-35
07	True Airspeed	11.2-48
08	Mach Number	11.2-49
09	Calibrated Airspeed	11.2-48
10	True Angle of Attack	11.2-30
11	Pressure Ratio	Ref. Para. 11.2.1
12	Air Density Ratio	Ref. Para. 11.2.1
13	True Freestream Air Temp.	11.2-42
14	Pressure Altitude Rate	11.2-45
15	Indicated Airspeed	11.2-48
16	Static Pressure	Ref. Para. 11.2.1
17	Total Pressure	Ref. Para. 11.2.1
18	Impact Pressure	Ref. Para. 11.2.1
19	Total Temperature	11.2-42
20	Ambient (Static) Air Temp.	11.2-42
21	Indicated Angle of Attack	11.2-30
22	Altitude Hold	11.2-34
23	Mach Hold	Ref. Para. 11.2.1

Table 11.3-4. Recommended Radar Altimeter Standard Message

Message ID - A01

Word No.	Signal Name	Standard Word Table No.
01	Radar Altimeter Header Word	11.2-59
02, 03	Radar Altitude	11.2-35

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